KENWOOD

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SERVICE MANUAL

Model TS-770E

V-UHF ALL MODE DUO BANDER

SPECIFICATIONS

<GENERAL>

Frequency Range	144.0 ~ 146.0 MHz 430.0 ~ 440.0 MHz
Mode	SSB (USB, LSB), CW, FM
Voltage Requirements	220V (W), 240V (T) AC 50/60 Hz 12.0 ~ 16.0V DC (13.8V DC nominal)
Power Consumption	Receive (no signal): 45 watts [220V (W), 240V (T) AC], 1.5A (13.8V DC) Transmit: 130 watts [220V (W), 240V (T) AC], 6A (13.8V DC)
Semiconductor Complement	Transistors: 163 FETs: 31 ICs: 75 Diodes: 224 (W), 225 (T)
Dimensions	290 (W) x 124 (H) x 320 (D) mm (11"-7/16) x (4"-7/8) x (12"-5/8)
Weight	11 kg (24.2 lbs)

<TRANSMITTER SECTION>

RF Power Output	SSB, CW, FM: 10 watts FM (LOW): Approx. 1 watt
Modulation	SSB: Balanced modulation FM: Variable reactance frequency shift
Maximum frequency deviation (FM)	±5 kHz
Carrier Suppression	Better than 40 dB
Unwanted Sideband Suppression	Better than 40 dB
Spurious Radiation	Better than –60 dB
Microphone Impedance	500 ~ 600Ω
Antenna Impedance	50Ω
AF Response of Transmitter (SSB)	400 ~ 2,600 Hz (–9 dB)
Repeater Frequency Shift	–600 kHz (144.0 ~ 146.0 MHz) +1.6 MHz or –7.6 MHz (430.0 ~ 440.0 MHz)
RPT Tone Frequency	1750 Hz

<RECEIVER SECTION>

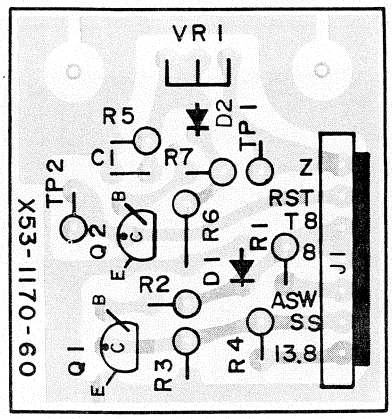
Receiver Sensitivity	SSB, CW: 0.25 μV for 10 dB (S + N)/N FM: 1 μV for 30 dB (S + N)/N 0.2 μV (144 ~ 146 MHz), 0.3 μV (430 ~ 440 MHz) for 12 dB SINAD
Intermediate Frequency	1st: 21.6 MHz 2nd: 8.83 MHz (144 MHz FM 455 kHz)
Image Rejection	1st IF: Better than 60 dB 2nd IF: Better than 50 dB
IF Rejection	Better than 70 dB
Squelch Sensitivity	0.25 μV
Audio Output	2.5 watts (with less than 10% distortion) into an 4 ohm load
Receiver Selectivity	SSB, CW: 2.4 kHz (–6 dB) 4.8 kHz (–60 dB) FM: 12 kHz (–6 dB) 24 kHz (–60 dB)
Frequency Stability	Within ±1 kHz during the first hour after 1 minute of warmup Within 150 Hz during any 30 minute period after warmup.

Circuit and ratings are subject to change without notice for improvement.

PC BOARD VIEWS

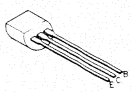
CONTROL Unit (X53-1170-60)

(View from component side)

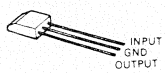


Q1,2:2SC1815(Y)
D1:XZ-080 D2:MA522(Q)or(R)

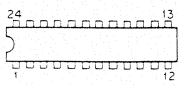
2SA1015(Y)
2SC1815(Y)



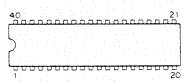
μPC78L05A



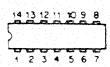
HD74154P



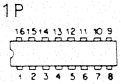
MN9004



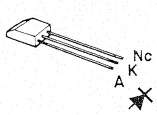
HD74LS00P HD74LS11P TC4011BP
HD74LS02P HD74LS20P TC4023BP
HD74LS03P HD74LS30P TC4025BP
HD74LS04P HD74LS32P TC4030BP
HD74LS08P HD74LS132P TC4069BP
HD74LS10P HD7404P



HD74LS75P MN1201A
HD74LS151P MSM4040RS
HD74LS157P TC4008BP
HD74221P

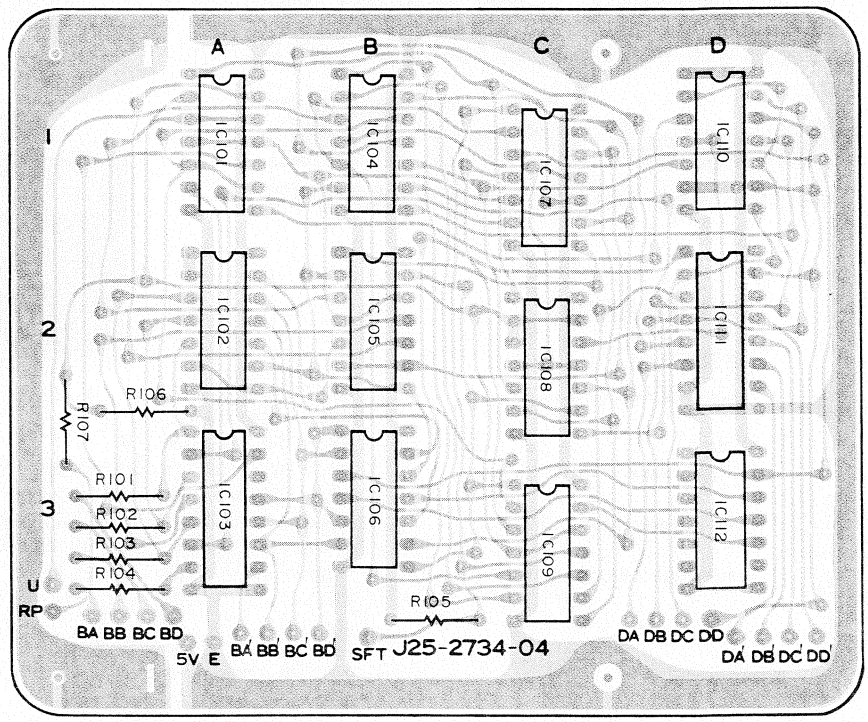


MA522(Q,R)



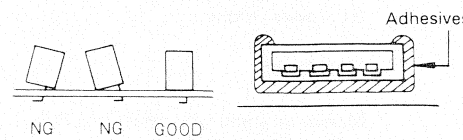
DIGITAL Unit (X54-1490-61)

(View from component side)



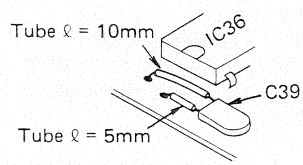
<Attachment direction of the composite resisters.>

<Attachment method of the J2,3,8>

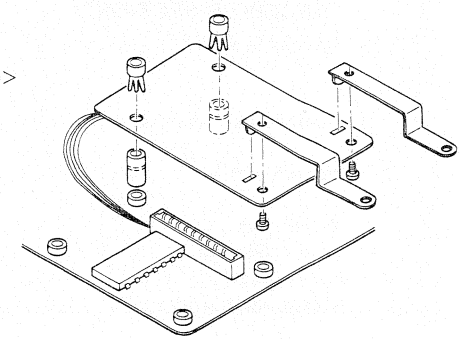


In case of J2, 3, 8, after inserting them into the printed circuit plate, bend the pins at the back side and make them come into close contact with the printed circuit plate.
Furthermore, after dipping, apply sufficient amount of adhesives (Rubber type adhesives such as "Sony Bond" or "Cemedine Hi-Contact") around the connector portion, and fix it in place.

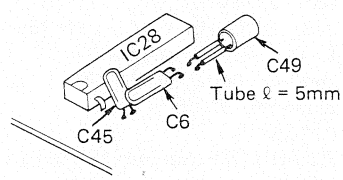
<Attachment method of C39>



<Attachment method of RPT unit>



<Attachment method of C6, C45 and C49>

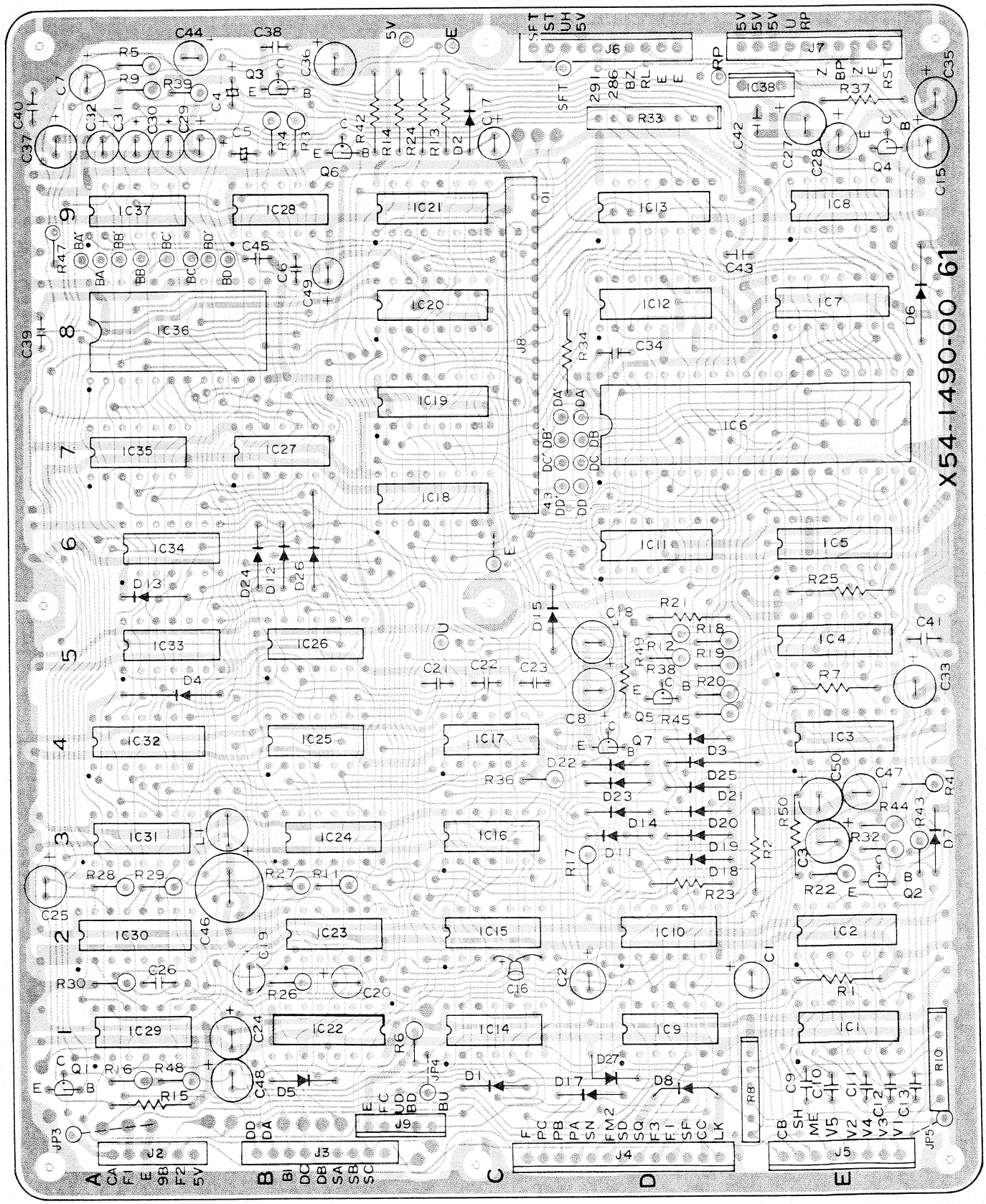


DIGITAL Unit

Q1,3~5:2SA1015(Y) Q2,6,7:2SC1815(Y) D1~3,5,7,8,11~15,17~24:1S1555 D4,6,25~27:1N60 IC1,2:HD74LS03P
IC3,26:HD74LS08P IC4,5:HD74LS157P IC6:MN9004 IC7,13:MN1201A IC8:HD74LS32P IC9,14,16,24,29:HD74LS00P
IC10:HD74LS02P IC11,12:HD74LS75P IC15:HD74LS132P IC17,37:HD74LS04P IC18~21:HD74LS151P IC22:MSM404RS
IC23:HD7404P IC25,31,32:HD74LS20P IC27:HD74LS11P IC28:HD74LS10P IC30:HD74221P IC33~35:HD74LS30P IC36:HD74154P
IC38:μPC78L05A IC101,108,109,112:TC4023BP IC102:TC4025BP IC103,111:TC4008BP IC104~106:TC4011BP IC107:TC4069BP
IC110:TC4030BP

PC BOARD VIEW

DIGITAL Unit (X54-1490-61) (View from component side)



PARTS LIST

Item	Abbreviation	Item	Abbreviation
Transistor	TR	Mica	MC
Capacitor	Cap	Mylar	ML
Ceramic	C	Styrene	S
Electrolytic	E	Tantalum	T

☆ New parts

Ref. No.	Parts No.	Description	Remarks
	GENERAL		
	A01-0728-11	Case (A) TOP	☆
	A01-0729-31	Case (B) BOTTOM	☆
	A21-0737-03	Ornamental panel	☆
	A23-1426-02	Rear panel	☆
	B01-0617-05	Panel escutcheon	☆
	B05-0708-04	Speaker grill cloth	☆
	B07-0617-05	Band SW Ass'y	☆
	B07-0618-05	Switch grill	☆
	B07-0623-15	Dial escutcheon Ass'y	☆
	B10-0627-15	Front glass	☆
	B11-0403-15	Filter for display	☆
PL1~3	B30-0804-05	Pilot lamp	
M-1	B31-0613-05	Meter (A) S meter	☆
M-2	B31-0614-05	Meter (B) Center meter	☆
	B42-1648-04	Indicating plate (VOX)	☆
	B42-1668-04	Indicating plate (A) FUSE	☆
	B42-1669-04	Indicating plate (B) AC 220V **W**	☆
	B42-1683-04	Indicating plate (C) AC 240V **T**	☆
	B43-0622-04	Badge **W**	☆
	B43-0635-04	Badge **T**	☆
	B50-2717-00	Operating manual **T**	☆
	B50-2722-00	Operating manual **W**	☆
C1	C90-0805-05	E 1000μF 25V	☆
C2~5	C91-0402-05	C 0.001μF	
C6~9	CE02W1E102	E 1000μF 25V	
C7	CC45SL1H101J	C 100pF ±5%	
J6	E06-0451-15	4P metal socket MIC	
J5	E06-0751-05	DIN socket	
	E07-0751-05	DIN plug	
J10	E08-0304-05	Power jack (3P)	
J1	E08-0409-05	4P square socket AC	
J2	E11-0003-15	Speaker jack	
J3	E11-0005-15	Key jack	
J4	E11-0034-25	Phone jack	
	E12-0001-05	Earphone plug	
J9	E21-0007-05	Ground terminal	☆
	E22-0207-05	Lug plate 1L2P	
	E22-0222-05	Lug plate 1L2P	
	E22-0405-05	Lug plate x 3 1L4P	
	E23-0015-04	Lug terminal	
	E31-0433-15	Flat cable 6P	☆
	E31-0434-15	Flat cable 9P	☆
	E31-0435-05	Flat cable 19P	☆

Ref. No.	Parts No.	Description	Remarks
	F05-2023-05	Fuse x 2 2A	
	F15-0165-14	Switch mask (B) LEVER SW	
	F15-0619-04	Shadow mask (B)	☆
	F15-0620-04	Switch mask (A) TIGHT KNOB	☆
	G09-0403-14	Bent spring	☆
	G09-0409-04	Cable stopper	☆
	G10-0606-04	Cushion cloth x 2	☆
	H01-2678-04	Carton (inside) **T**	☆
	H01-2679-04	Carton (inside) **W**	☆
	H03-1717-04	Carton (outside)	☆
	H10-1276-04	Cushion	
	H10-2511-02	Front packing fixture	☆
	H10-2512-02	Rear packing fixture	☆
	H20-1406-03	Protective bag	☆
	H21-0701-04	Protection sheet TOP	
	H25-0016-04	Accessory bag	
	H25-0036-04	Accessory bag	
	J02-0022-05	Foot (small) x 4 15φ	
	J02-0049-14	Foot (large) x 6 20φ	
	J13-0033-15	Fuse holder	
	J21-2578-04	Brake	☆
	J25-2743-14	PC board (A) TONE SW	☆
	J31-0504-04	Collar for brake	☆
	J32-0727-04	Round boss (A)	☆
	J32-0728-04	Round boss (B)	☆
	J32-1030-14	Round boss for front foot	
	J42-0410-05	Flexible bush 58mm	☆
	J42-0411-05	Flexible bush 53mm	☆
	K01-0402-15	Handle	☆
	K21-0279-14	Knob (C) x 2 RIT, FUNCTION	
	K21-0308-14	Knob (G) x 4 AF, etc.	
	K21-0309-14	Knob (H) x 3 RF, etc.	
	K21-0727-13	Main knob	☆
	K21-0729-04	Knob (B) SQ	
	K21-0742-04	Pointer knob MODE	☆
	K23-0705-04	Lever knob (B) STBY	
	K23-0707-04	Lever knob (A) x 4	
	K23-0712-04	VOX knob x 3	
	K23-0714-04	Tight knob	☆
	K27-0402-04	Push knob (A) MEMORY	☆
	K27-0403-04	Push knob (B) x 5 S/F, etc.	☆
	K27-0404-04	Push knob (C) x 2 TONE, etc.	☆
	K29-0710-05	Band knob (A) x 2 UP, DOWN	☆
	K29-0711-05	Band knob (B) FIX	☆
	K29-0719-05	Band knob (C) x 3	☆

PARTS LIST

Ref. No.	Parts No.	Description	Re-marks
T1	L01-8046-05	Power transformer	☆
T2	L01-8012-05	Power transformer **W**	☆
T2	L01-8052-05	Power transformer **T**	☆
L1, 2	L33-0601-05	Choke coil	
L3	L15-0301-05	Low frequency choke coil	☆
	L92-0110-05	Bead core	☆
	N09-0256-05	Ground screw	
	N10-2030-46	Hex nut	
	N33-3006-45	Round flat screw x 4 (speaker)	
	N35-3006-45	Bind screw x 22	
	N35-3008-45	Case screw above S meter	
R1	RS14AB3D100J	Metal film 10Ω 2W ±5%	
R2, 3	RD14BB2E101J	Carbon 100Ω 1/4W ±5%	
R4	RS14AB3F4R7J	Metal film 4.7Ω 3W ±5%	
R5	RD14BB2E471J	Carbon 470Ω 1/4W ±5%	
R6	RD14BB2E103J	Carbon 10kΩ 1/4W ±5%	
R7	RD14BB2E332J	Carbon 3.3kΩ 1/4W ±5%	
R8	RD14BB2E153J	Carbon 15kΩ 1/4W ±5%	
S1	S44-1404-05	Paddle switch POWER	☆
S2	S31-2027-05	Slide switch BACK UP	
S3	S01-1411-05	Rotary switch MODE	☆
S4	S40-2405-05	Push switch VFO	
S5	S40-2413-05	Push switch TONE **W**	☆
	S50-1402-05	Tact switch	☆
	T03-0031-15	Speaker	
	T91-0024-05	Microphone **T**	
	T91-0026-05	Microphone **W**	
D1	V11-2163-66	Rectifier stack M4C-6	
D2	V11-3161-96	Diode 6CD13	
D3, 4	V11-7260-66	LED PR2112D	
D5	V11-4163-46	Zener diode XZ-080	
D6	V11-1162-06	Diode MA520	☆
IC1	V30-1159-06	IC μPC7805H	☆
IC2	V30-1029-66	IC FS-7808M	
	X41-1160-00	6 KEY SWITCH Unit	
	X41-1180-00	LEVER SWITCH Unit	
	X42-1070-60	POWER CORD Ass'y	
	X43-1310-00	AVR Unit	
	X44-1270-00	RF Unit	
	X48-1250-00	MIX (A) Unit	
	X48-1260-00	MIX (B) Unit	
	X48-1270-00	IF Unit	
	X49-1120-62	AF VOX Unit	☆
	X50-1510-00	CAR Unit	
	X50-1520-00	VCO Unit	
	X50-1530-00	PLL (A) Unit	
	X50-1540-00	PLL (B) Unit	
	X52-1110-51	TONE Unit **T**	
	X52-1110-62	TONE Unit **W**	
	X53-1080-00	MIC VR Unit	
	X53-1090-00	AF VR Unit	
	X53-1170-60	CONTROL Unit	☆
	X54-1390-00	DISPLAY Unit	
	X54-1490-61	DIGITAL Unit	☆
	X56-1310-01	144 FINAL Unit	
	X56-1320-01	430 FINAL Unit	
	X60-1080-61	ENCODER Ass'y	

Ref. No.	Parts No.	Description	Re-marks
CONTROL UNIT (X53-1170-60)			
C1	CC45SL1H101J	C 100pF ±5%	
J1	E40-0773-05	Mini connect wafer	
	J31-0502-04	PC board collar x 2	
	J42-0404-05	PC board bush x 2	
VR1	R12-3425-05	Semi fixed resistor 10kΩ (B)	☆
	R92-0150-05	Short jumper x 2	
D1	V11-4163-46	Zener diode XZ-080	
D2	V11-1162-16	Diode MA522 (Q) or (R)	☆
Q1, 2	V03-1815-06	TR 2SC1815 (Y)	

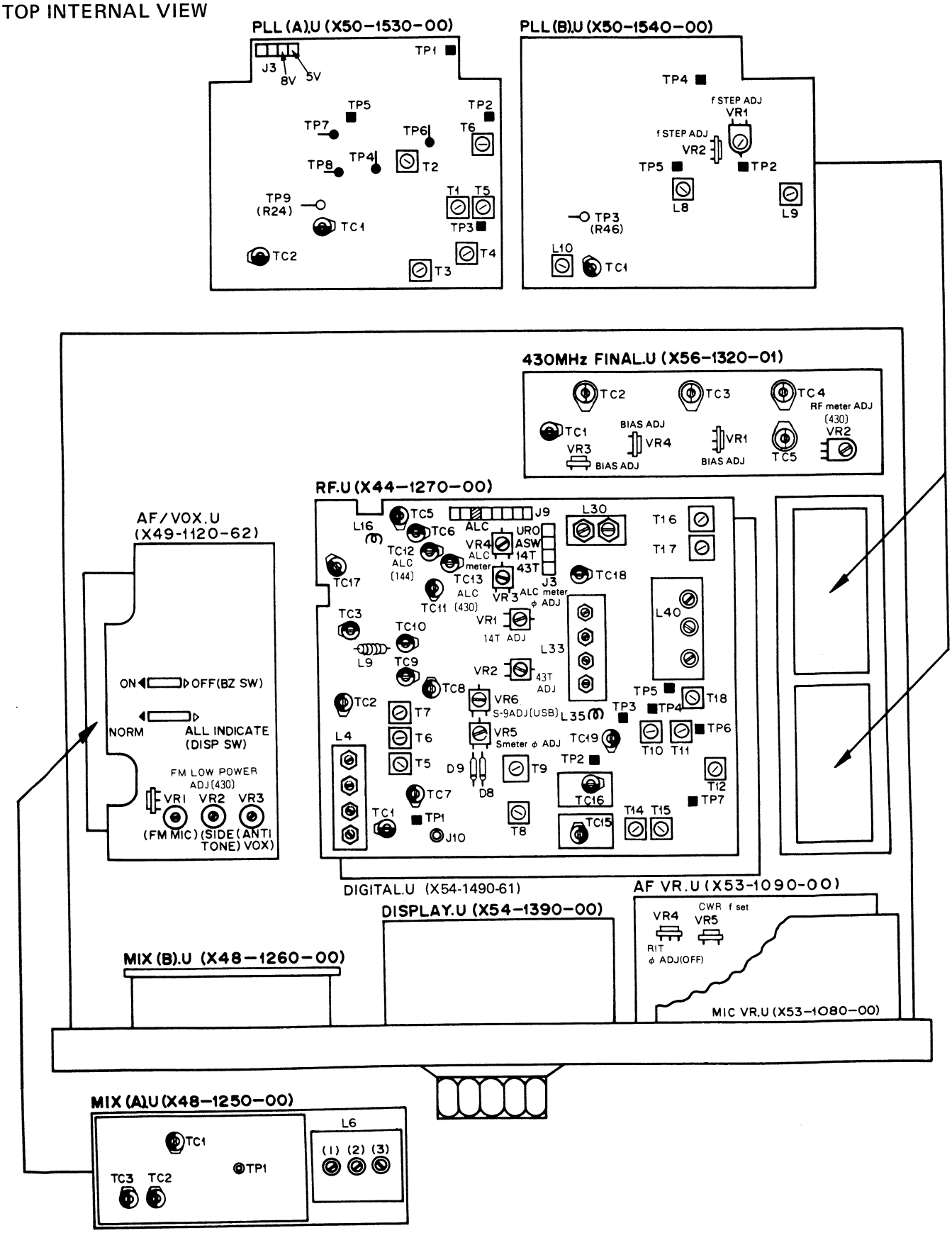
PARTS LIST

Ref. No.	Parts No.	Description	Re-marks
DIGITAL UNIT (X54-1490-61)			
C1, 2	CE04W1C100Q	E 10μF 16V	
C3	CE04W1A470Q	E 47μF 10V	
C4, 5	CS15E1E010M	T 1μF 25V	
C6	CQ92M1H102K	ML 0.001μF ±10%	
C7	CE04W1HR47Q	E 0.47μF 50V	
C8	CE04W0J101Q	E 100μF 6.3V	
C9~13	CQ92M1H223K	ML 0.022μF ±10%	
C14		Not used	
C15	CE04W0J101Q	E 100μF 6.3V	
C16, 17	CE04W1A100	E 10μF 10V	
C18	CE04W0J101Q	E 100μF 6.3V	
C19, 20	CS15E1ER15M	T 0.15μF 25V	
C21~23	CQ92M1H103K	ML 0.01μF ±10%	
C24	CE04W1A470Q	E 47μF 10V	
C25	CE04W1H4R7Q	E 4.7μF 50V	
C26	C91-0446-05	C 100pF ±5%	
C27	CE04W0J101Q	E 100μF 6.3V	
C28	CE04W1HR47Q	E 0.47μF 50V	
C29~32	CE04W1H010Q	E 1μF 50V	
C33	CE04W1H4R7Q	E 4.7μF 50V	
C34	C91-0445-05	C 56pF ±5%	
C35~37	CE04W1A470Q	E 47μF 10V	
C38~41	CQ92M1H103K	ML 0.01μF ±10%	
C42	CE04W1A470Q	E 47μF 10V	
C43	CQ92M1H102K	ML 0.001μF ±10%	
C44	CE04W1A470Q	E 47μF 10V	
C45	CQ92M1H472K	ML 0.0047μF ±10%	
C46	CE04W0J471Q	E 470μF 6.3V	
C47~49	CE04W1H010Q	E 1μF 50V	
C50	CE04W1A470Q	E 47μF 10V	
J1		Not used	
J2	E10-0651-05	FFC connector 6P	
J3	E10-0951-05	FFC connector 9P	
J4	E40-1373-05	Mini connect wafer 13P	
J5	E40-0873-05	Mini connect wafer 8P	
J6, 7	E40-1073-05	Mini connect wafer 10P	
J8	E10-1951-05	FFC connector 19P	
J9	E40-0573-05	Mini connect wafer 5P	
	J31-0502-04	PC board collar x 9	
	J31-0513-05	Collar bush x 2	☆
	J42-0404-05	PC board bush x 9	
L1	L40-4725-04	Ferri-inductor 4.7mH	
JP1~4	R92-0150-05	Short jumper x 4	
R8	R90-0509-05	Composite resistor 22kΩ x 5	
R10	R90-0524-05	Composite resistor 1.8kΩ x 5	
R33	R90-0508-05	Composite resistor 470Ω x 4	
R31, 35, 40, 46, 51		Not used	

Ref. No.	Parts No.	Description	Re-marks
D1~3	V11-0076-05	Diode 1S1555	
D4	V11-0051-05	Diode 1N60	
D5	V11-0076-05	Diode 1S1555	
D6	V11-0051-05	Diode 1N60	
D7, 8	V11-0076-05	Diode 1S1555	
D9, 10		Not used	
D11~15	V11-0076-05	Diode 1S1555	
D16		Not used	
D17~24	V11-0076-05	Diode 1S1555	
D25~27	V11-0051-05	Diode 1N60	
Q1	V01-1015-06	TR 2SA1015 (Y)	
Q2	V03-1815-06	TR 2SC1815 (Y)	
Q3~5	V01-1015-06	TR 2SA1015 (Y)	
Q6, 7	V03-1815-06	TR 2SC1815 (Y)	
IC1, 2	V30-1007-46	IC HD74LS03P or	
	V30-0267-10	SN74LS03N	
IC3	V30-1007-66	IC HD74LS08P	
IC4, 5	V30-1008-36	IC HD74LS157P	
IC6	V30-1008-76	IC MN9004	
IC7	V30-1008-66	IC MN1201A	
IC8	V30-1008-16	IC HD74LS32P	
IC9	V30-1046-06	IC HD74LS00P or	
	V30-0301-30	SN74LS00N	
IC10	V30-1007-36	IC HD74LS02P or	
	V30-1041-06	SN74LS02N	
IC11, 12	V30-1008-96	IC HD74LS75P	
IC13	V30-1008-66	IC MN1201A	
IC14	V30-1046-06	IC HD74LS00P or	
	V30-0301-30	SN74LS00N	
IC15	V30-1060-06	IC HD74LS132P	
IC16	V30-1046-06	IC HD74LS00P or	
	V30-0301-30	SN74LS00N	
IC17	V30-1007-56	IC HD74LS04P	
IC18~21	V30-1008-26	IC HD74LS151P	
IC22	V30-1158-06	IC MSM4040RS	☆
IC23	V30-1008-46	IC HD7404P	
IC24	V30-1046-06	IC HD74LS00P or	
	V30-0301-30	SN74LS00N	
IC25	V30-1007-96	IC HD74LS20P	
IC26	V30-1007-66	IC HD74LS08P	
IC27	V30-1007-86	IC HD74LS11P	
IC28	V30-1007-76	IC HD74LS10P	
IC29	V30-1046-06	IC HD74LS00P or	
	V30-0301-30	SN74LS00N	
IC30	V30-1059-06	IC HD74221P or	
	V30-1087-06	SN74221N	
IC31, 32	V30-1007-96	IC HD74LS20P	
IC33~35	V30-1008-06	IC HD74LS30P	
IC36	V30-1008-56	IC HD74154P	
IC37	V30-1007-56	IC HD74LS04P	
IC38	V30-1029-46	IC μPC78L05A	
IC101	V30-0301-60	IC TC4023BP	☆
IC102	V30-1156-06	IC TC4025BP	☆
IC103	V30-1026-26	IC TC4008BP	
IC104~106	V30-0301-70	IC TC4011BP	
IC107	V30-0297-20	IC TC4069UBP	☆
IC108, 109	V30-0301-60	IC TC4023BP	☆
IC110	V30-1143-06	IC TC4030BP	
IC111	V30-1026-26	IC TC4008BP	
IC112	V30-0301-60	IC TC4023BP	☆

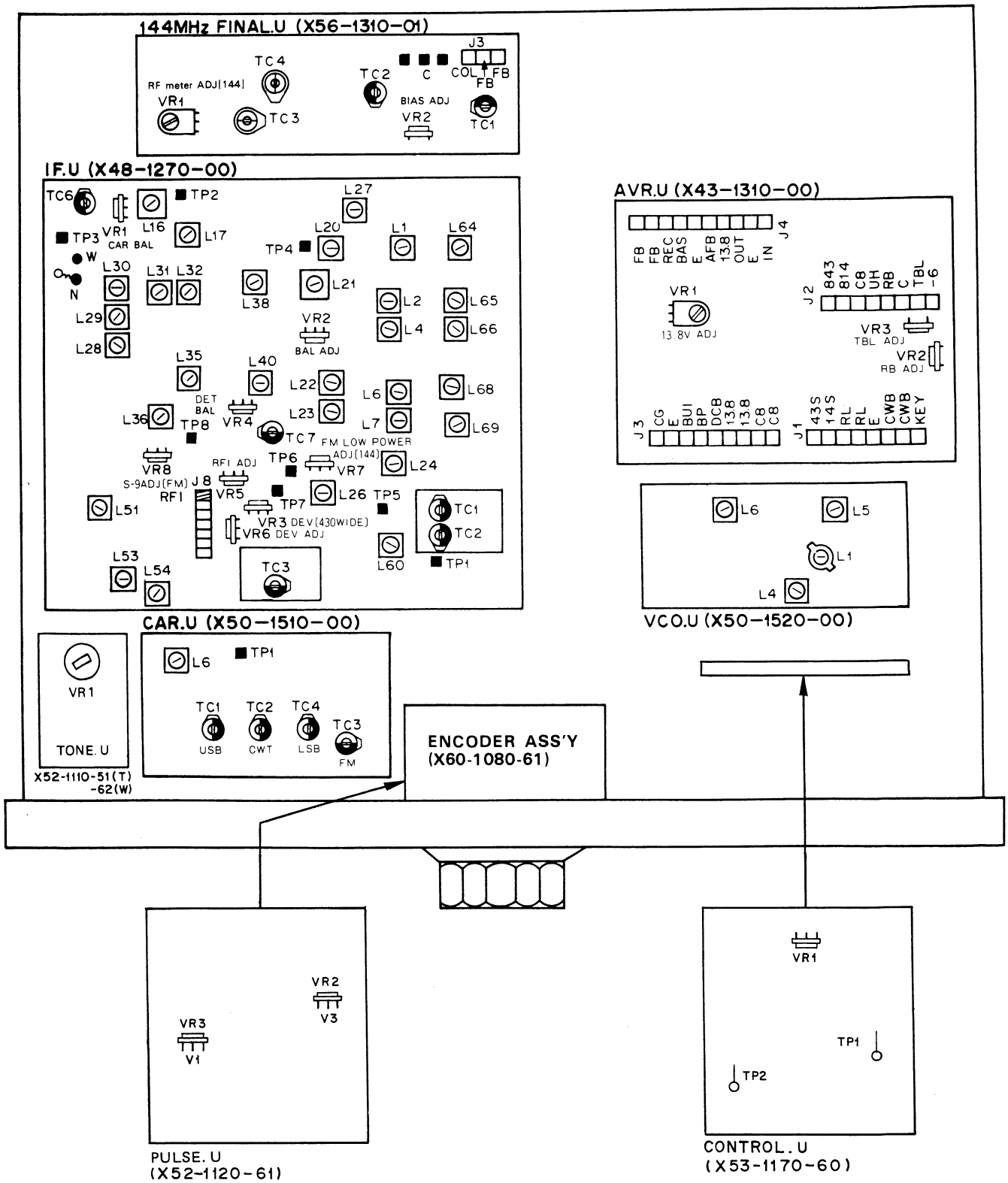
ADJUSTMENTS

TOP INTERNAL VIEW



ADJUSTMENTS

BOTTOM INTERNAL VIEW



CIRCUIT DESCRIPTION

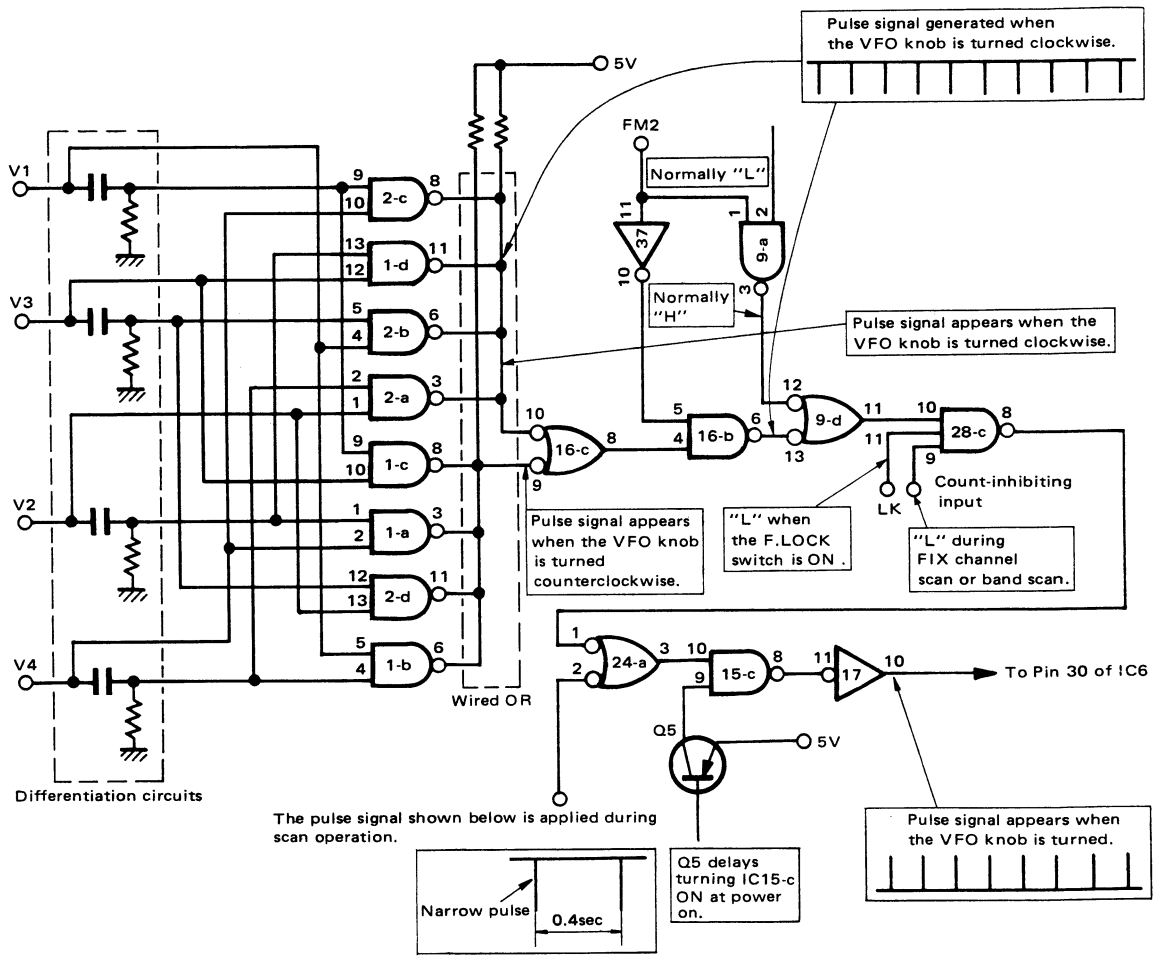


Fig. 17 VFO pulse counting

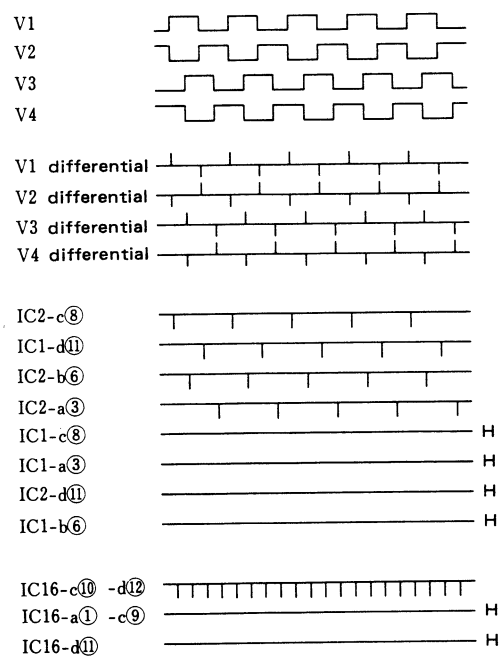


Fig. 16 (A) UP count timing chart

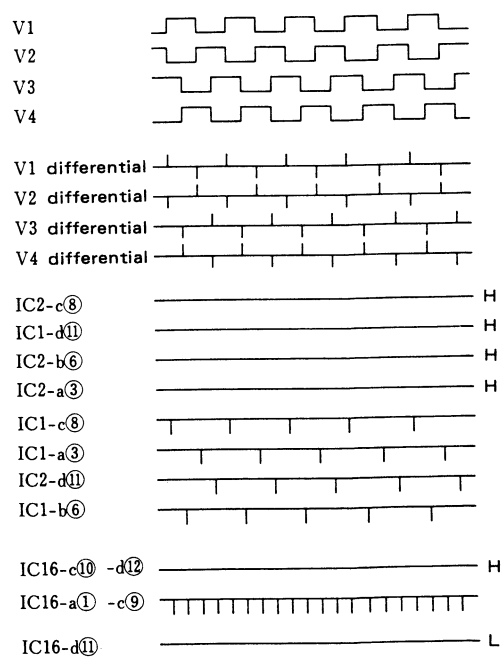


Fig. 16 (B) DOWN count timing chart

CIRCUIT DESCRIPTION

2. UP/ DOWN discrimination

The pulse signals obtained with IC1, IC2 and the wired OR circuit are applied to the $\overline{R}\cdot\overline{S}$ flip- flop consisting of IC16-a and IC16-d. When Pin 12 of IC16-d is supplied with the pulse signal, Pin 11 of IC16-d becomes "H".

The VFO knob rotational direction(UP or DOWN) or BAND change direction(UP or DOWN) is discriminated with IC14-d and IC14-b.

In the F.LOCK mode, Pin 12 of IC16-d and Pin1 of IC16-a are both "H" to keep the $\overline{R}\cdot\overline{S}$ flip-flop in the state it was in just before the F.LOCK switch is pressed. IC37 and IC10-d reset the $\overline{R}\cdot\overline{S}$ flip-flop to the UP state when the SLOW/FAST switch or FUNCTION switch is switched.

$\overline{R}\cdot\overline{S}$ flip-flop operation is explained below. The $\overline{R}\cdot\overline{S}$ flip-flop circuit is shown in **Fig. 19** and its truth table is shown in **Table 8**. The circuit consists of two NAND gates. There are two input terminals, $\overline{S}$ and $\overline{R}$, and two output terminals Q and $\overline{Q}$. $\overline{Q}$ is the negative output of Q. The output of the flip-flop circuit always takes this from. When both $\overline{S}$ and $\overline{R}$ inputs are "1" the circuit maintains the current state. Although the **Fig. 19** shows the state where Q="1" and $\overline{Q}$="0" , the opposite state is also maintained. When either input is "1" and the other is "0", the state is reversed. It is inhibited to apply "0" to both input terminals.

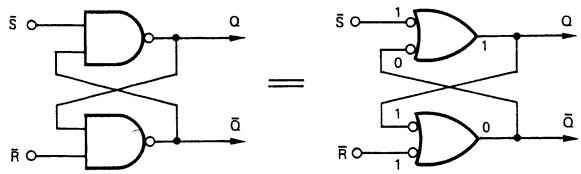


Fig. 19 $\overline{R}\cdot\overline{S}$ flip-flop consisting of NAND gates

Input		Output		
$\overline{S}$	$\overline{R}$	Q	$\overline{Q}$	
0	0	Inhibited		
0	1	1	0	Set
1	0	0	1	Reset
1	1	Previous state maintained		

Table 8 $\overline{R}\cdot\overline{S}$ flip-flop truth table

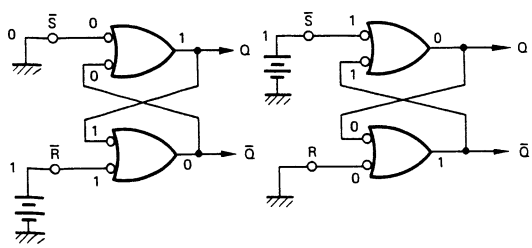


Fig. 20 $\overline{R}\cdot\overline{S}$ flip-flop operation

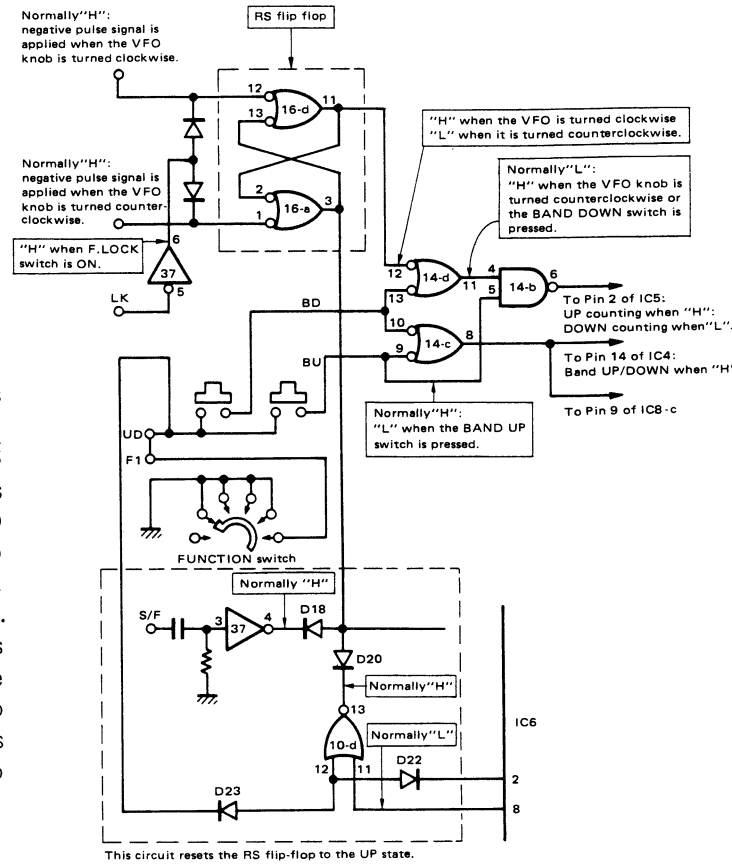


Fig. 18 UP/DOWN discrimination

3. SLOW/FAST circuit

IC28-a and IC28-b form a T flip-flop, which alternates its state every time the S/F switch is pressed. Its negative output is output from Pin 6 of IC28-b. IC8-d, IC23 and IC10-b reset the T flip-flop to the SLOW state when the FUNCTION switch is switched.

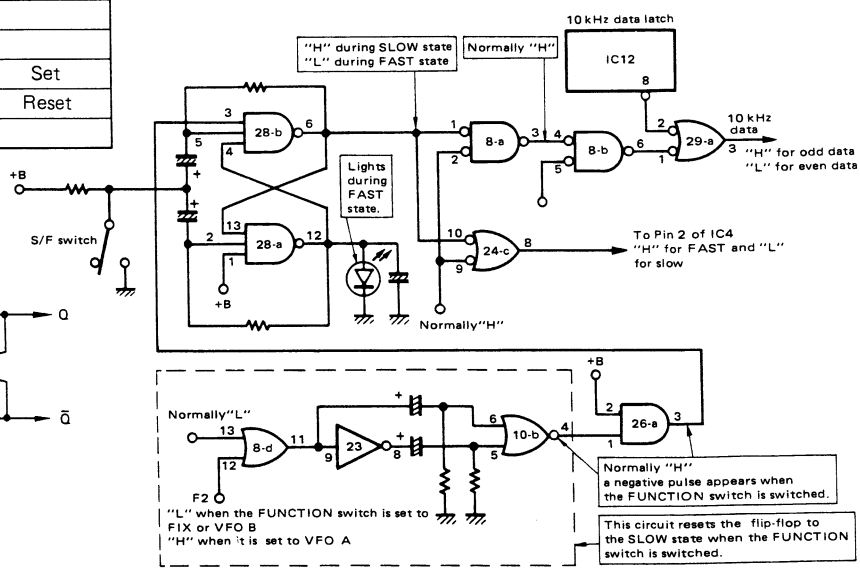


Fig. 21 SLOW/FAST flip-flop circuit

CIRCUIT DESCRIPTION

4. Scan operations

When the SCAN switch is turned ON, Pin 4 of the microprocessor IC6 becomes "H", then, Pin 6 of IC3-b becomes "H". The scan pulse signal with a period of 0.4 sec is subject to AND with this "H" level signal.

Then, the scan pulse signal is applied to Pin 10 of IC30 through IC29-b. IC 30 outputs a negative pulse signal from Pin 12 which is applied to Pin 2 of IC24-a.

When a signal is received and the squelch circuit opens, Pin 12 of IC15-d becomes "H" and Pin 11 becomes "L" to stop scanning. When either the BAND UP or DOWN switch or the FIX switch is pressed and kept on, scan operation will start after a while. When either the BAND UP or DOWN switch is pressed, Pin 9 of IC8-c is "H" and when the FIX switch is pressed, Pin 10 of IC8-c is "H". In both cases, Pin 8 of IC8-c is "H".

Then, Pin 4 of IC15-b becomes "H" somewhat later because of the delay circuit consisting of R13 and C16.

When Pin 8 of IC8-c is "L", Q1 is ON because the base current flows through R14 → D2.

Therefore, its collector level is "H". However, when Pin 8 of IC8-c is "H", D2 is reverse biased and a current flows through R14→C17. Thus, C17 is charged. After C17 has been charged, the base current of Q1 is cut off and the collector is open. Thus, the scan pulse signal for BAND or FIX channel scan are fed to Pin 5 of IC15-b.

5. Control signal selection circuit

IC4 and IC5 select the microprocessor input signals according to the select signal applied to Pin 1 of both IC4 and IC5 from the microprocessor. For signals selected, see **Fig. 23.**

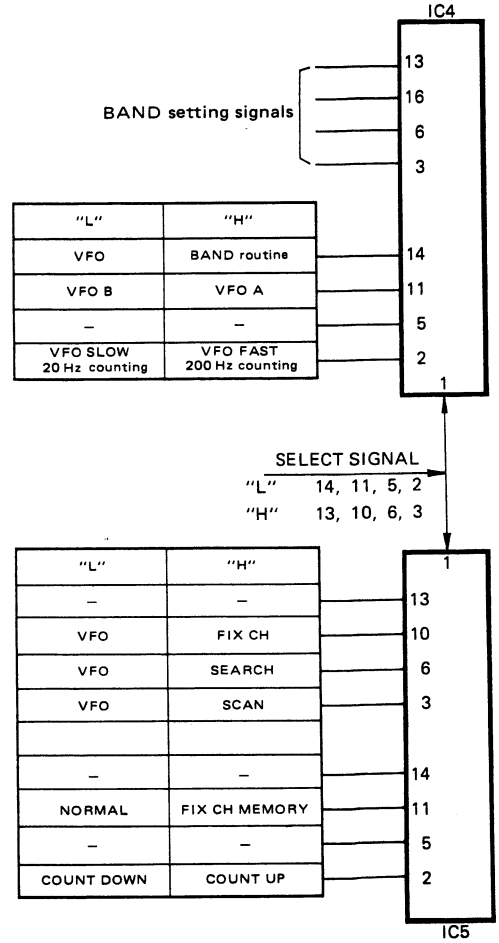


Fig. 23 Control signal selection ciruit

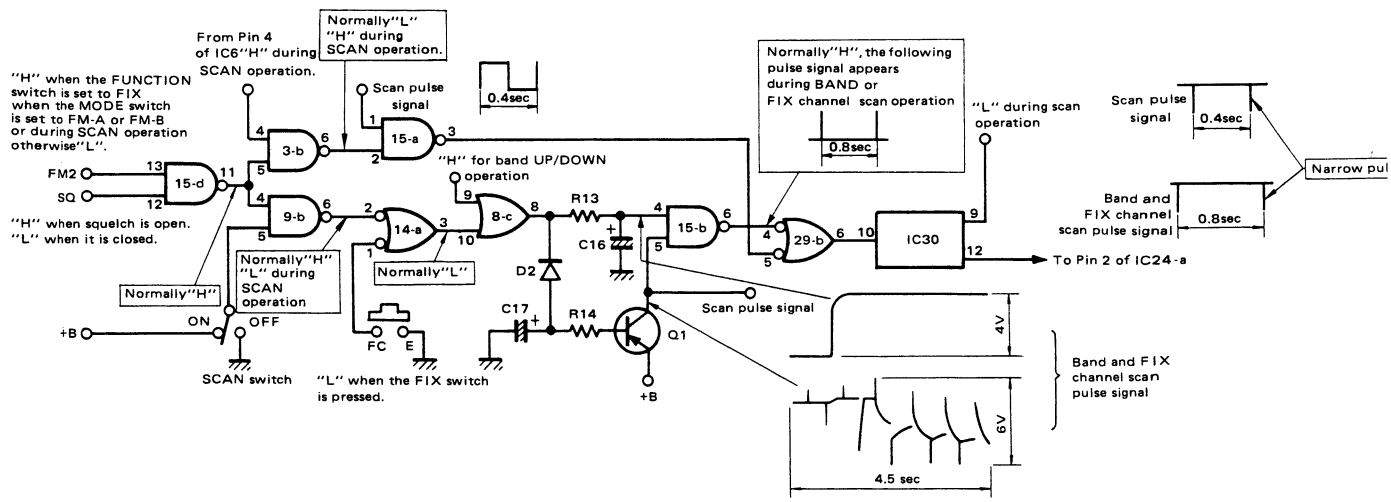


Fig. 22 Scan operation

CIRCUIT DESCRIPTION

INPUT				OUTPUT
STROBE	SELECT	A	B	Y
H	X	X	X	L
L	L	L	X	L
L	L	H	X	H
L	H	X	L	L
L	H	X	H	H

L: Low level
H: High level
X: either "H" or "L"

Table 9 Functions of HD74LS157P

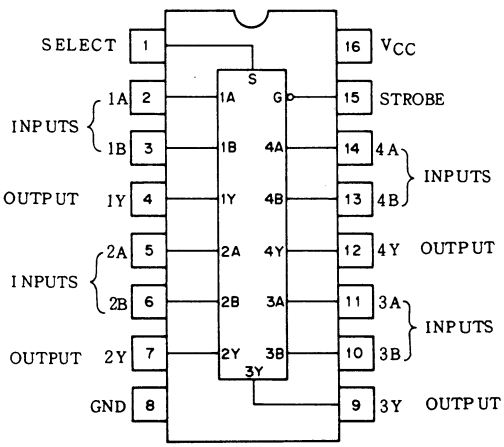


Fig. 24 IC4 and 5 (HD74LS157P) pin connections

6. Scan pulse generator

The astable multivibrator consisting of IC23 oscillates at about 5.3 kHz. This frequency is divided into various frequencies by IC22.

Pin 7 about 5.3kHz x 2^{-2} =about 1.3kHz SA terminal
Pin 6 about 5.3kHz x 2^{-3} =about 660Hz SB terminal
Pin 5 about 5.3kHz x 2^{-4} =about 330Hz SC terminal
} Display scan signals

Pin 15 about 5.3kHz x 2^{-11} =about 2.5Hz SCAN signal
Pin 1 about 5.3kHz x 2^{-12} =about 1.25Hz FIX channel BAND and scan signal

7. Blanking circuit

Signal 9B from the display unit ("H" when the 9th digit is displayed) is used to turn off the frequency indication by IC17, IC24-d, IC3-c and Q7 when the selected FIX channel is not preset.

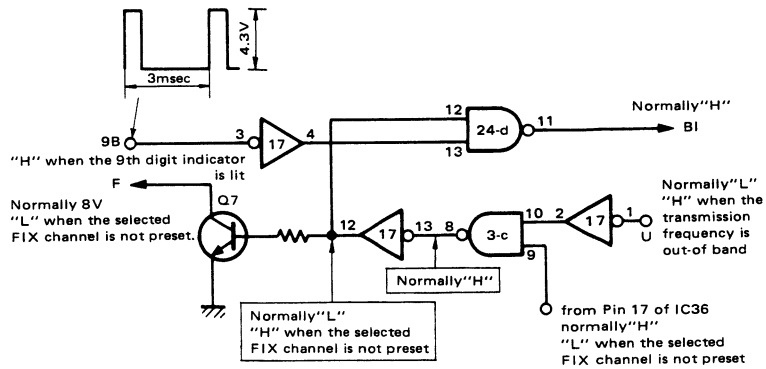


Fig. 27 Blanking ciruit

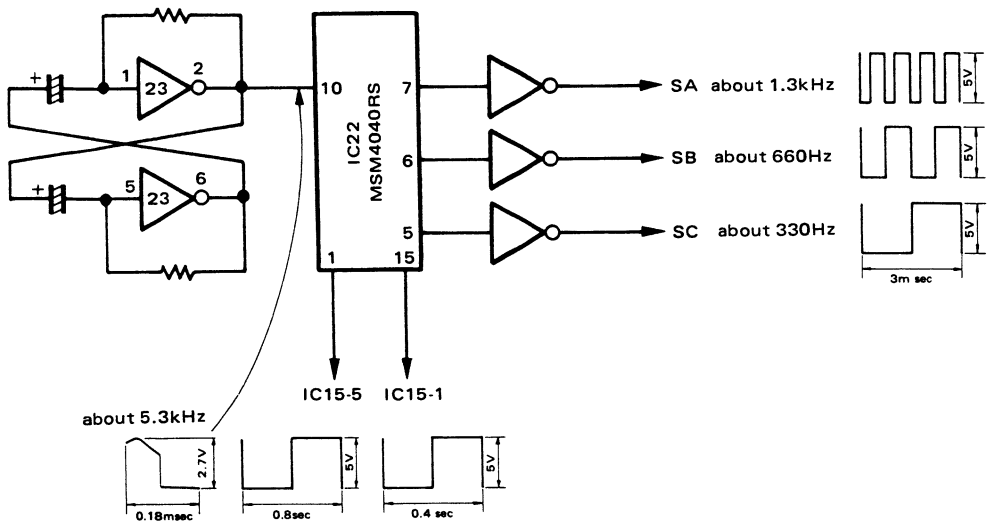


Fig. 25 Scan pulse generator

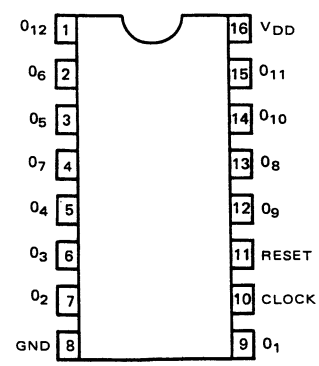


Fig. 26 IC22 (MSM4040RS) pin connections

CIRCUIT DESCRIPTION

8. Other microprocessor peripheral circuits

1) Reset circuit
Q2 in the control unit (X53-1170-01) forms the reset circuit.

2) Buzzer circuit
The output signals from Pins 2, 5 and 6 of the microprocessor IC are applied to the circuit consisting of IC29-c, IC29-d, IC30, Q6 and Q3 to sound the buzzer.
The buzzer sounds in any of the following cases:
   a. When either BAND switch is pressed,
   b. When the FIX switch is pressed,
   c. When the VFO frequency skips from 999.9 to 000.0 kHz or vice versa.

3) FIX channel number latch
The channel number latch strobe signal is generated by the circuit which differentiates the signal output from Pin 6 of IC6; it consists of IC37, R47 and C45.

4) Various inhibiting circuits
   a. The circuit consisting of IC3-a, IC3-d and Q2 inhibits SCAN and SEARCH operations during transmission.
   b. The circuit consisting of IC10-c and IC32 inhibits transmission when the selected FIX channel is not preset or during SCAN or SEARCH operation.

INPUT			OUTPUT	
CLEAR	A	B	Q	$\bar{Q}$
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	↑	⊓	⊔
H	↓	H	⊓	⊔
↑	L	H	⊓	⊔

Note) ⊓ :one "H" level pulse
⊔ :one "L" level pulse

Table 10 HD74221P truth table

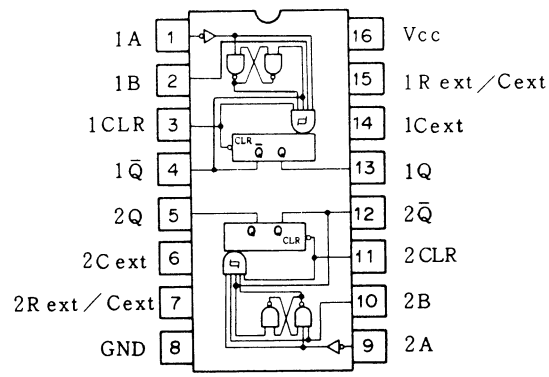


Fig. 28 IC30 (HD74221P) pin connections

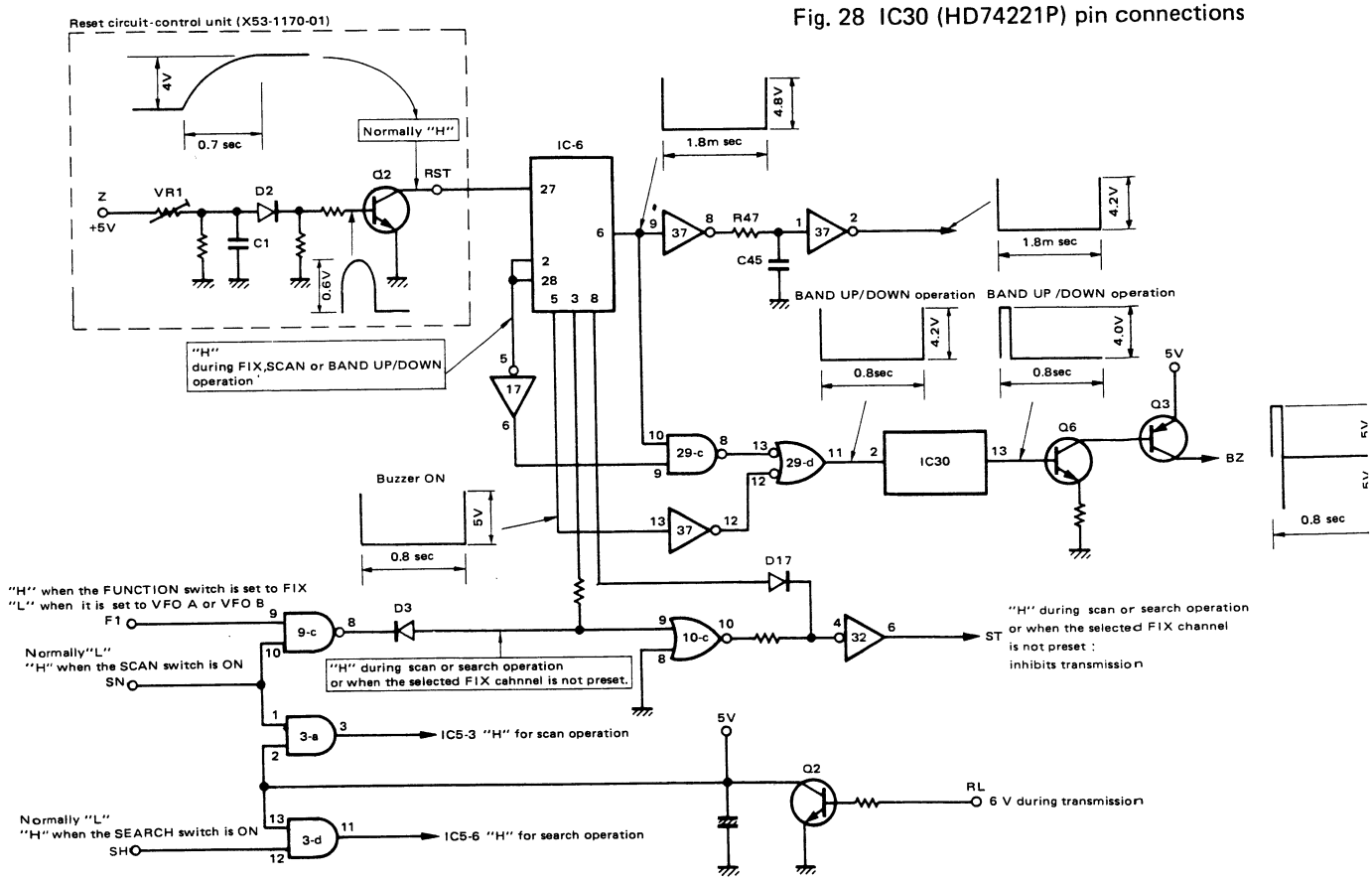


Fig. 29 Other microprocessor peripheral ciruits

CIRCUIT DESCRIPTION

9. Band data and MHz data generator

Data from the microprocessor is applied to IC36, which converts binary data into hexadecimal data. One of the 16 output terminals of IC36 is always "L". IC24-b, IC34, IC32-b, IC35, IC26 and IC27-c generate band data fed to the display.

IC31-a, IC31-b, IC33, IC27-a and IC27-b generate band data fed to PLL.

IC25-a, IC25-b, IC26-b, IC26-d generate "286", "291" and UH signals and 100 MHz and 10 MHz data supplied to the display.

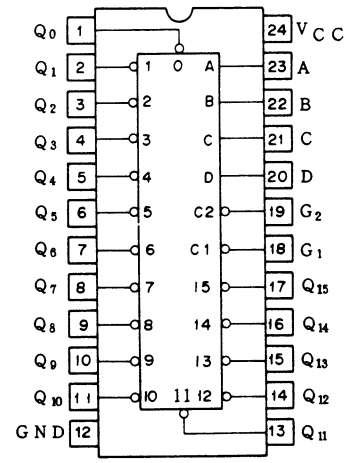


Fig. 30 IC36 (HD74154P) pin connections

INPUT						OUTPUT																				
G_1	G_2	D	C	B	A	Q_0	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_7	Q_8	Q_9	Q_{10}	Q_{11}	Q_{12}	Q_{13}	Q_{14}	Q_{15}						
0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
0	0	0	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1						
0	0	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1						
0	0	0	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1						
0	0	0	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1						
0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1						
0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1						
0	0	1	0	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1						
0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1						
0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1						
0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1						
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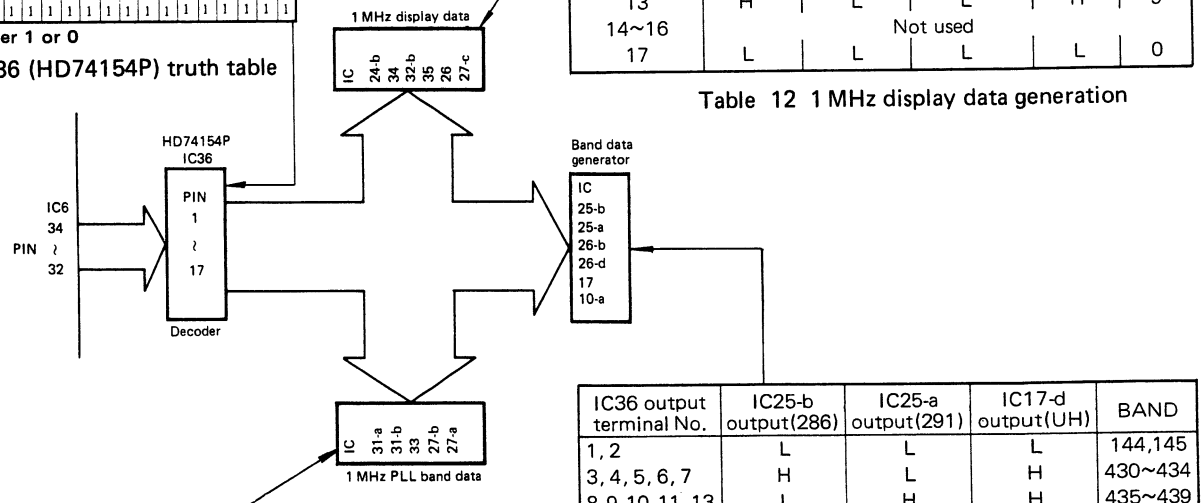
0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1						
0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0						
0	1	×	×	×	×	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
1	0	×	×	×	×	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
1	1	×	×	×	×	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						

Note) X : either 1 or 0

Table 11 IC36 (HD74154P) truth table

IC36 output terminal	IC24-b output	IC34 output	IC32-b output	IC35 output	MHz data
1	L	H	L	L	4
2	L	H	L	H	5
3	L	L	L	L	0
4	L	L	L	H	1
5	L	L	H	L	2
6	L	L	H	H	3
7	L	H	L	L	4
8	L	H	L	H	5
9	L	H	H	L	6
10	L	H	H	H	7
11	H	L	L	L	8
13	H	L	L	H	9
14~16	Not used				
17	L	L	L	L	0

Table 12 1 MHz display data generation



IC36 output terminal No.	IC25-b output(286)	IC25-a output(291)	IC17-d output(UH)	BAND
1, 2	L	L	L	144,145
3, 4, 5, 6, 7	H	L	H	430~434
8,9,10,11,13	L	H	H	435~439

Note: When UH is "L", the 100 MHz indication is "1" and the 10 MHz indication is "4".
When UH is "H", the 100 MHz indication is "4" and the 10 MHz indication is "3".

Table 14 Band data generation

IC36 output termianl No.	IC31-a output (PC)	IC31-b output (PB)	IC33 output (PA)
1, 3, 8	L	L	H
2, 4, 9	L	H	L
5, 10	L	H	H
6, 11	H	L	L
7, 13	H	L	H
17	L	L	L

Table 13 1 MHz PLL data generation

Fig. 31 Band and MHz data generation circuits

CIRCUIT DESCRIPTION

10. Display data selector

IC7, IC12 and IC13 latch 10 Hz through 100 kHz data. IC18 through IC21 latch data for display and output the data to the display unit according to the scan pulse signal.

IC11 latches the selected channel number.

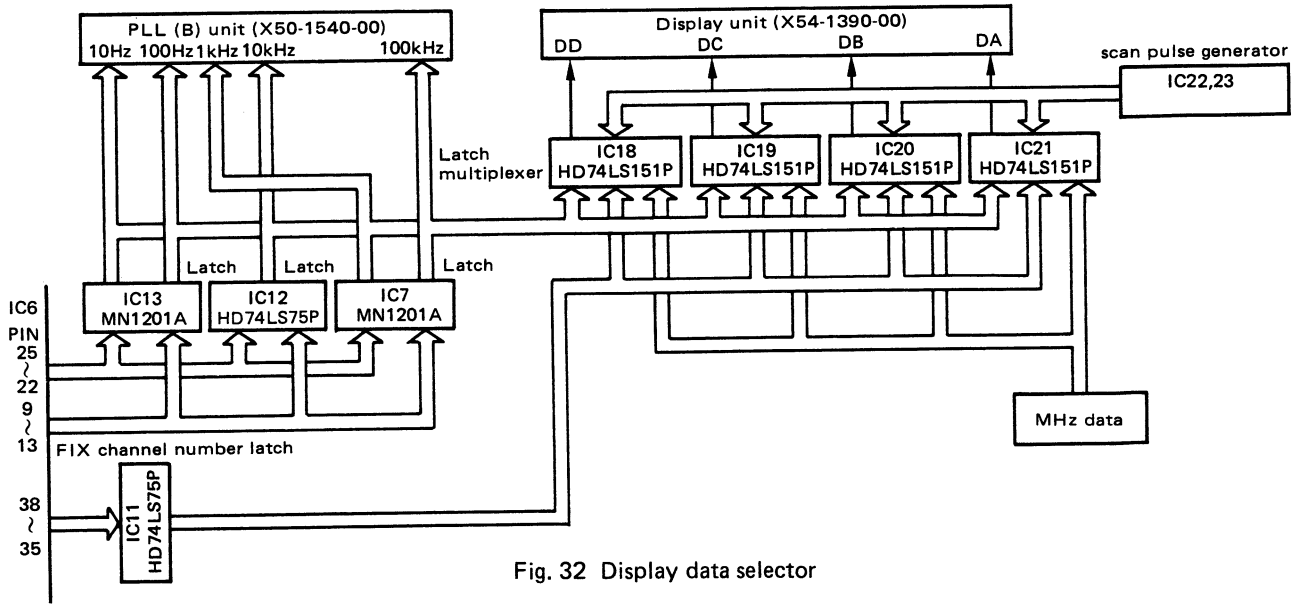


Fig. 32 Display data selector

Symbol	Terminal name	Explanation
IN1~IN4	Input terminal	Input terminals for 4 bit data
AO1~AO4	Output terminal	Outputs data which was latched by clock pulse CKA.
BO1~BO4	Output terminal	Outputs data which was latched by clock pulse CKB.
CKA	Clock A terminal	Clock signal applied to latches 4 bit data in 4 bit latch A at its rising edge.
CKB	Clock B terminal	Clock signal applied to latches 4 bit data in 4 bit latch B at its rising edge.

Table 15 Explanation of terminals of IC7 and IC13 (MN1201A)

INPUT		OUTPUT	
D	G	Q	$\overline{Q}$
L	H	L	H
H	H	H	L
X	L	Q_0	$\overline{Q_0}$

Note: H: High level
L: Low level
X: Either H or L
Q_0: The level of Q just before the input condition is settled.
$\overline{Q_0}$: Complement of Q_0

Table 16 Functions of IC11 and IC12 (HD74LS75P)

Input					Output	
SELECT				STR OBE	Y	W
C	B	A	S			
X	X	X	H		L	H
L	L	L	L		D_0	$\overline{D_0}$
L	L	H	L		D_1	$\overline{D_1}$
L	H	L	L		D_2	$\overline{D_2}$
L	H	H	L		D_3	$\overline{D_3}$
H	L	L	L		D_4	$\overline{D_4}$
H	L	H	L		D_5	$\overline{D_5}$
H	H	L	L		D_6	$\overline{D_6}$
H	H	H	L		D_7	$\overline{D_7}$

Note: H: High level
L: Low level
X: Either H or L
Do to D7:
Levels of inputs Do to D7

Table 17 Functions of IC18 to IC21 (HD74LS151P)

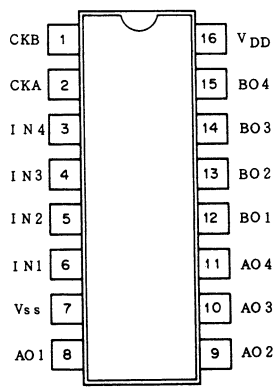


Fig. 33 IC7 and IC13 (MN1201A) pin connections

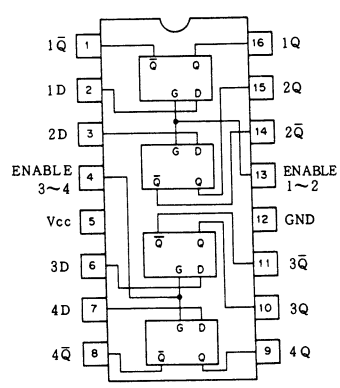


Fig. 34 IC11 and IC12 (HD74LS75P) pin connections

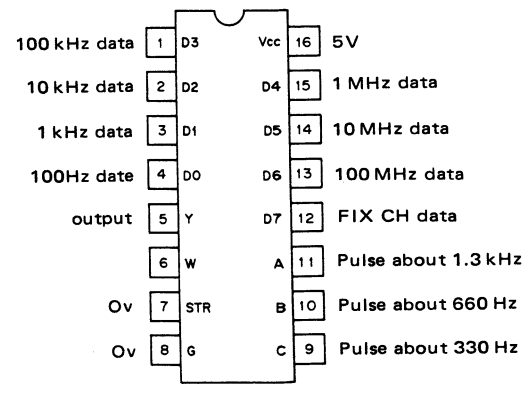


Fig. 35 Pin connections of IC18 to IC21 (HD74LS151P)

CIRCUIT DESCRIPTION

11. Repeater circuit

This circuit shifts the transmission frequency so that repeaters can be used with the TS-770E. On the 70 cm band, when the MODE switch is in the FM-A position, the transmission frequency is shifted by −7.6 MHz; and when the MODE switch is in the FM-B position, the transmission frequency is shifted by +1.6 MHz. On the 2 meter band, the transmission frequency is shifted by −600 kHz in both the FM-A and FM-B position.

The level at the RP terminal is "H" and the transmission frequency is shifted only when the RPT switch is "ON". The reception frequency is not shifted.

For shifting the transmission frequency, the difference between the transmission and reception frequencies to be shifted is added to the reception frequency. The level at the SET terminal determines the difference between the transmission and the reception frequencies on the 70 cm band.

When removing the RF unit to repair the repeater circuit, connect the SCAN terminal (ASW terminal) of plug 53 to the 5 V terminal of plug 43 through a 100 ohm resistor.

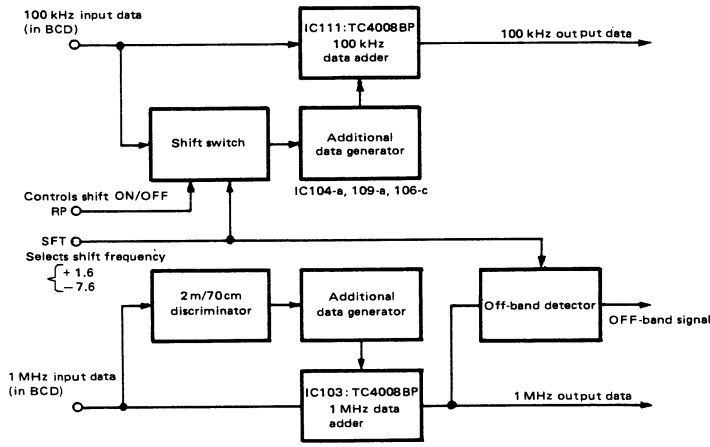


Fig. 36 Repeater ciruit block diagram

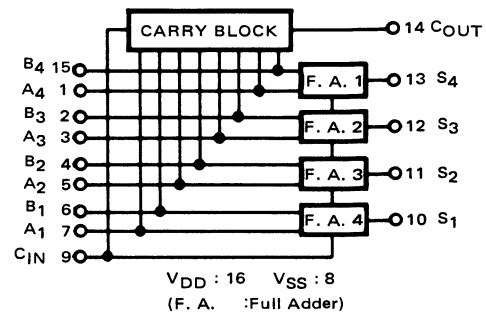


Fig. 37 IC103 and 111 (TC4008BP) Pin connections

1) 100 kHz data adder

IC110, IC104-c, IC108-a, IC108-b, IC108-c and IC101-a generate 100 kHz data as shown in **Tables 18 and 19**.

IC101-a, IC108-a, IC108-b and IC108-c operate as shift switches. When RP is "L", data to be added is "0".

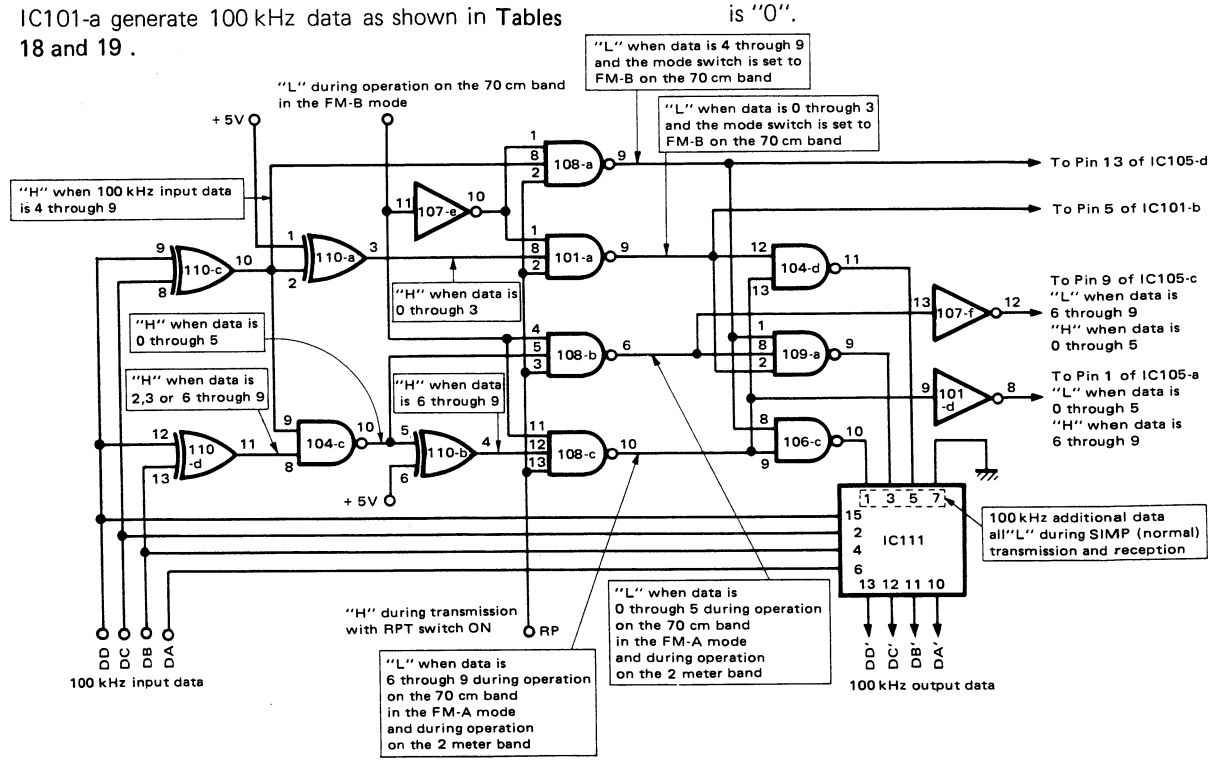


Fig. 38 100 kHz data generator

CIRCUIT DESCRIPTION

100 kHz data on the 70 cm band in the FM-A mode(Shifted – 7.6 MHz)
100 kHz data on the 2 meter band in the FM-A and FM-B modes (Shifted – 600 kHz)

100 kHz display data	100 kHz data: Input data IC111 15 2 4 6	100 kHz data: Additional data IC111 1 3 5 7	100 kHz data: Output data IC111 13 12 11 10	100 kHz display data when the frequency is shifted
0	0 0 0 0	4 0 1 0 0	0 1 0 0	4
1	0 0 0 1	4 0 1 0 0	0 1 0 1	5
2	0 0 1 0	4 0 1 0 0	0 1 1 0	6
3	0 0 1 1	4 0 1 0 0	0 1 1 1	7
4	0 1 0 0	4 0 1 0 0	1 0 0 0	8
5	0 1 0 1	4 0 1 0 0	1 0 0 1	9
6	0 1 1 0	A 1 0 1 0	0 0 0 0	0
7	0 1 1 1	A 1 0 1 0	0 0 0 1	1
8	1 0 0 0	A 1 0 1 0	0 0 1 0	2
9	1 0 0 1	A 1 0 1 0	0 0 1 1	3

Table 18. 100 kHz data (1)

100 kHz data on the 70 cm band in the FM-B mode (Shifted + 1.6 MHz)

100 kHz display data	100 kHz data: Input data IC111 15 2 4 6	100 kHz data: Additional data IC111 1 3 5 7	100 kHz data: Output data IC111 13 12 11 10	100 kHz display data when the frequency is shifted
0	0 0 0 0	6 0 1 1 0	0 1 1 0	6
1	0 0 0 1	6 0 1 1 0	0 1 1 1	7
2	0 0 1 0	6 0 1 1 0	1 0 0 0	8
3	0 0 1 1	6 0 1 1 0	1 0 0 1	9
4	0 1 0 0	C 1 1 0 0	0 0 0 0	0
5	0 1 0 1	C 1 1 0 0	0 0 0 1	1
6	0 1 1 0	C 1 1 0 0	0 0 1 0	2
7	0 1 1 1	C 1 1 0 0	0 0 1 1	3
8	1 0 0 0	C 1 1 0 0	0 1 0 0	4
9	1 0 0 1	C 1 1 0 0	0 1 0 1	5

Table 19. 100 kHz data (2)

2) 1 MHz data adder

IC102-a and IC102-b check the upper 3 bits of the 4 bit 1 MHz data to determine whether operation is on the 70 cm band.

Pin 6 of IC102-a is "H" during operation on the 2 meter band.

IC105, IC101-c and IC101-b generate the 1 MHz addition data, "0,1,2,8,9 or F," according to the conditions of the carry of the 100 kHz adder, the above 70 cm discrimination signal and the SFT signal. IC103 adds this data to the 1 MHz data to generate the band data.

For the MHz addition data, see **Tables 20 and 21.**

3) Off-band detection

The off-band detection circuit checks the 1 MHz data, 70 cm band discrimination signal and the SFT signal and outputs an "H" level signal at terminal U when the transmission frequency is out-of -band. When the level at terminal U is "H", the frequency indicator is off and VCO output is cut off.

MHz data in the FM-B mode

Band	MHz data: Band input data IC103 1 3 5 7	MHz data: Additional data IC103 15 2 4 6	MHz data: Output data IC103 13 12 11 10	Frequency displayed	U signal
144.0~144.5	0 0 0 0 0	F 1 1 1 1	F 1 1 1 1	OFF	H
144.6~144.9	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	144.0~144.3	L
145.0~145.5	1 0 0 0 1	F 1 1 1 1	F 1 1 1 1	144.4~144.9	L
145.6~145.9	1 0 0 0 1	0 0 0 0 0	1 0 0 0 0	145.0~145.3	L
430.0~430.3	2 0 0 1 0	1 0 0 0 1	3 0 0 1 1	431.6~431.9	L
430.4~430.9	2 0 0 1 0	2 0 0 1 0	4 0 1 0 0	432.0~432.5	L
431.0~431.3	3 0 0 1 1	1 0 0 0 1	4 0 1 0 0	432.6~432.9	L
431.4~431.9	3 0 0 1 1	2 0 0 1 0	5 0 1 0 1	433.0~433.5	L
432.0~432.3	4 0 1 0 0	1 0 0 0 1	5 0 1 0 1	433.6~433.9	L
432.4~432.9	4 0 1 0 0	2 0 0 1 0	6 0 1 1 0	434.0~434.5	L
433.0~433.3	5 0 1 0 1	1 0 0 0 1	6 0 1 1 0	434.6~434.9	L
433.4~433.9	5 0 1 0 1	2 0 0 1 0	7 0 1 1 1	435.0~435.5	L
434.0~434.3	6 0 1 1 0	1 0 0 0 1	7 0 1 1 1	435.6~435.9	L
434.4~434.9	6 0 1 1 0	2 0 0 1 0	8 1 0 0 0	436.0~436.5	L
435.0~435.3	7 0 1 1 1	1 0 0 0 1	8 1 0 0 0	436.6~436.9	L
435.4~435.9	7 0 1 1 1	2 0 0 1 0	9 1 0 0 1	437.0~437.5	L
436.0~436.3	8 1 0 0 0	1 0 0 0 1	9 1 0 0 1	437.6~437.9	L
436.4~436.9	8 1 0 0 0	2 0 0 1 0	A 1 0 1 0	438.0~438.5	L
437.0~437.3	9 1 0 0 1	1 0 0 0 1	A 1 0 1 0	438.6~438.9	L
437.4~437.9	9 1 0 0 1	2 0 0 1 0	B 1 0 1 1	439.0~439.5	L
438.0~438.3	A 1 0 1 0	1 0 0 0 1	B 1 0 1 1	439.6~439.9	L
438.4~438.9	A 1 0 1 0	2 0 0 1 0	C 1 1 0 0	OFF	H
439.0~439.3	B 1 0 1 1	1 0 0 0 1	C 1 1 0 0	OFF	H
439.4~439.9	B 1 0 1 1	2 0 0 1 0	D 1 1 0 1	OFF	H

Table 20 1 MHz data (1)

MHz data in the FM-A mode

Band	MHz data: Band input data IC103 1 3 5 7	MHz data: Additional data IC103 15 2 4 6	MHz data: Output data IC103 13 12 11 10	Frequency displayed	U signal
144.0~144.5	0 0 0 0 0	F 1 1 1 1	F 1 1 1 1	OFF	H
144.6~144.9	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	144.0~144.3	L
145.0~145.5	1 0 0 0 1	F 1 1 1 1	0 0 0 0 0	144.4~144.9	L
145.6~145.9	1 0 0 0 1	0 0 0 0 0	1 0 0 0 1	145.0~145.3	L
430.0~430.5	2 0 0 1 0	8 1 0 0 0	A 1 0 1 0	OFF	H
430.6~430.9	2 0 0 1 0	9 1 0 0 1	B 1 0 1 1	OFF	H
431.0~431.5	3 0 0 1 1	8 1 0 0 0	B 1 0 1 1	OFF	H
431.6~431.9	3 0 0 1 1	9 1 0 0 1	C 1 1 0 0	OFF	H
432.0~432.5	4 0 1 0 0	8 1 0 0 0	C 1 1 0 0	OFF	H
432.6~432.9	4 0 1 0 0	9 1 0 0 1	D 1 1 0 1	OFF	H
433.0~433.5	5 0 1 0 1	8 1 0 0 0	D 1 1 0 1	OFF	H
433.6~433.9	5 0 1 0 1	9 1 0 0 1	E 1 1 1 0	OFF	H
434.0~434.5	6 0 1 1 0	8 1 0 0 0	E 1 1 1 0	OFF	H
434.6~434.9	6 0 1 1 0	9 1 0 0 1	F 1 1 1 1	OFF	H
435.0~435.5	7 0 1 1 1	8 1 0 0 0	F 1 1 1 1	OFF	H
435.6~435.9	7 0 1 1 1	9 1 0 0 1	0 0 0 0 0	OFF	H
436.0~436.5	8 1 0 0 0	8 1 0 0 0	0 0 0 0 0	OFF	H
436.6~436.9	8 1 0 0 0	9 1 0 0 1	1 0 0 0 1	OFF	H
437.0~437.5	9 1 0 0 1	8 1 0 0 0	1 0 0 0 1	OFF	H
437.6~437.9	9 1 0 0 1	9 1 0 0 1	2 0 0 1 0	430.0~430.3	L
438.0~438.5	A 1 0 1 0	8 1 0 0 0	2 0 0 1 0	430.4~430.9	L
438.6~438.9	A 1 0 1 0	9 1 0 0 1	3 0 0 1 1	431.0~431.3	L
439.0~439.5	B 1 0 1 1	8 1 0 0 0	3 0 0 1 1	431.4~431.9	L
439.6~439.9	B 1 0 1 1	9 1 0 0 1	4 0 1 0 0	432.0~432.3	L

Table 21 1 MHz data (2)

CIRCUIT DESCRIPTION

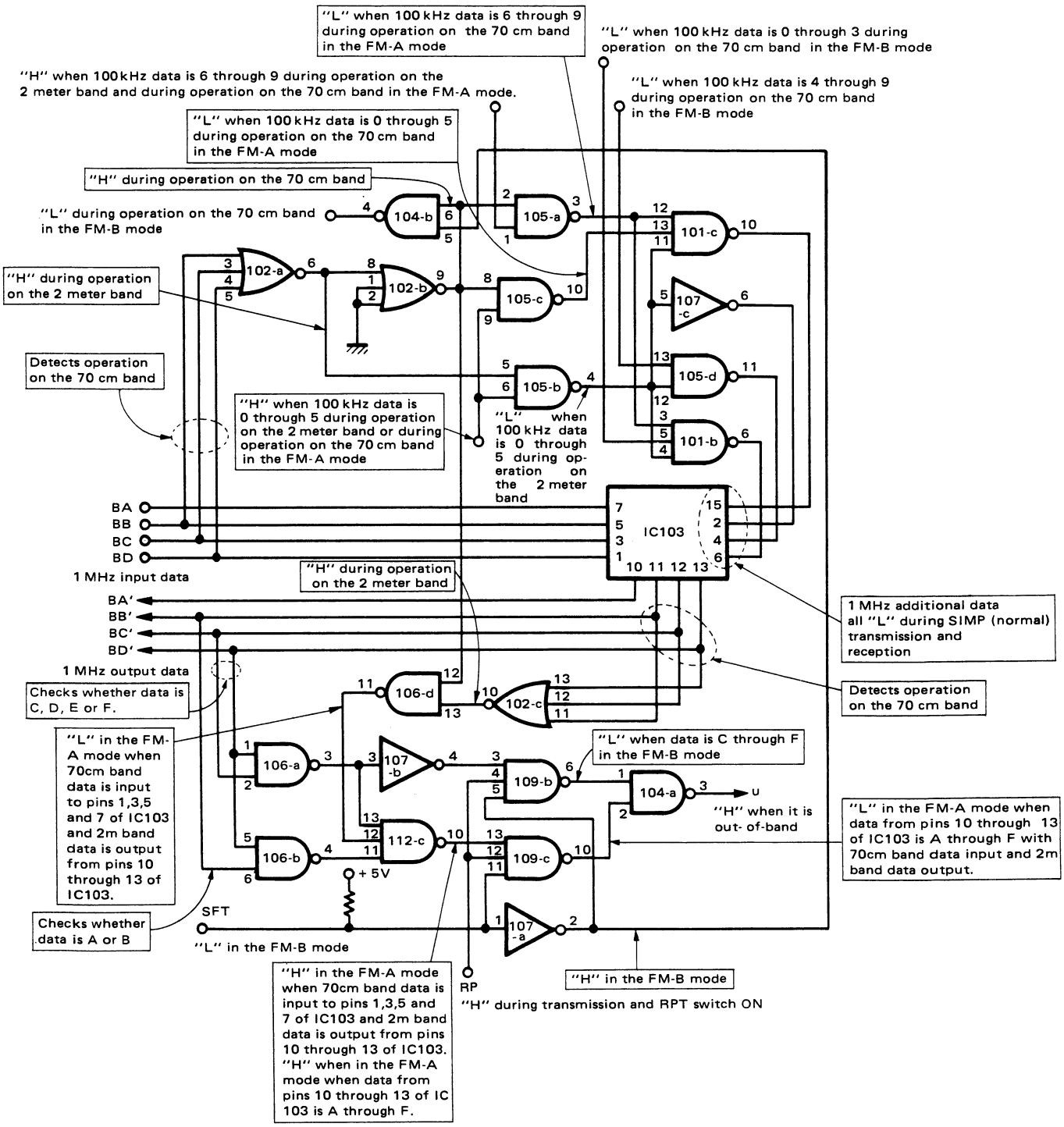


Fig. 39 1 MHz data generator

CIRCUIT DESCRIPTION

Terminal No.	Terminal name	In-put	Out-put	Explanation	Pulse
1	VSS			Ground	
2	CO11		O	"H" during FIX channel, scan or search operation; inhibits counting VFO pulses when "H"	
3	CO10		O	"H" when the selected FIX channel is not preset or during scan or search	
4	CO9		O	"H" during scan	
5	CO8		O	Buzzer output signal	O
6	CO7		O	Strobe signal for buzzer output, FIX CH and number latch	O
7	CO6		O	Select signal which is always output except when either CALL button is pressed	O
8	CO5		O	Normally "L"	
9	CO4		O	100 kHz strobe signal	O
10	CO3		O	10 kHz strobe signal	O
11	CO2		O	1 kHz strobe signal	O
12	CO1		O	100 Hz strobe signal	O
13	CO0		O	10 Hz strobe signal	O
14	AI3	O		A inputs	
15	AI2	O			
16	AI1	O			
17	AI0	O			
18	BI3	O		B inputs	
19	BI2	O			
20	BI1	O			
21	BI0	O			

Terminal No.	Terminal name	In-put	Out-put	Explanation	Pulse
22	EO0		O	PLL data outputs	O
23	EO1		O		O
24	EO2		O		O
25	EO3		O		O
26	TST	O		Unused	
27	RST	O		Normally "H"	
28	CSLCT	O		The same as terminal 2	
29	SNS0	O		Normally "L"	
30	SNS1	O		Count input	O
31	DO0		O	Band data (binary output)	
32	DO1		O		
33	DO2		O		
34	DO3		O		
35	DO4		O	FIX channel number data (binary output)	
36	DO5		O		
37	DO6		O		
38	DO7		O		
39	VDD	O		5 V DC	
40	OSC	O		Clock signal 400 kHz	

Table. 22 Digital unit IC6 (MN9004) terminal function

Terminal name		In-put	Out-put	Explanation
J2	5V		O	Supplied to display unit
	F2	O		"L" when the FUNCTION switch is set to FIX or VFO B and "H" when set to VFO-A
	9B	O		"H" when the 9th digit is displayed
	F1	O		Normally grounded open when the FUNCTION switch is set to FIX
	CA			Normally "L"
J3	SC		O	Digit scan signals
	SB		O	
	SA		O	
	DD		O	Display data signals output by the time sharing system
	DC		O	
	DB		O	
	DA		O	
	BI	O		Signal erasing the frequency indication when the selected FIX channel is not preset
J4	LK	O		Normally open "L" in the F.LOCK mode
	CC	O		Normally "L"
	SF	O		Normally open "L" when the S/F switch is pressed
	F1	O		Normally "L" open when the FUNCTION switch is set to FIX
	F3	O		"L" when the function switch is set to VFO A or B
	SQ	O		"H" when squelch is open and "L" when it is closed
	SD	O		"H" in the FAST/+ 10 kHz mode when it is "H", the FAST/+ 10 kHz LED lights
	SN	O		"H" when the SCAN switch is ON normally "L"
	PA		O	PLL band data output
	PB		O	
	PC		O	
	F	O		Normally "H", "L" when the selected FIX channel is not preset
J5	V1	O		Signals from the encoder assembly
	V3	O		
	V4	O		
	V2	O		

Terminal name		In-put	Out-put	Explanation
	V5	O		Normally "L"
	ME	O		Normally "L", "H" when the MEMORY switch is ON
	SH	O		Normally "L", "H" when the SEARCH switch is ON
J6	SFT			Connected to Pin 6 of the AUX connector
	ST		O	"H" when the selected FIX channel is not preset or in either the SCAN or SEARCH mode
	UH		O	When this signal is "L", the 100 MHz digit indicates "1" and 10 MHz digit "4", when it is "H" the 100 MHz digit indicates "4" and 10 MHz digit "3"
	5V	O		5 V DC supplied
	291		O	"H" when the frequency is between 435~439 MHz (Both signals are "L" when the frequency is 144 MHz)
	286		O	"H" when the frequency is between 430~434 MHz
	BZ		O	"H" when the buzzer sounds
	RL	O		8 V during transmission
J7	5V		O	5 V DC
	Z		O	Normally 5 V
	BP	O		Normally 13V, at least 7.5V is necessary for memory back-up
	RST	O		Normally "H"
J8	01~03		O	10 Hz digit data signals
	10~13		O	100 Hz digit data signals
	20~23		O	1 kHz digit data signals
	30~33		O	10 kHz digit data signals
	40~43		O	100 kHz digit data signals
J9	FC	O		"L" when the FIX switch is pressed
	UD	O		Normally "L", open in the FIX mode
	BD	O		"L" when the band DOWN switch is pressed
	BU	O		"H" when the band UP switch is pressed

Table. 23 Digital control unit (X54-1490-61) terminal function

CIRCUIT DESCRIPTION

PLL ASSEMBLY (X60-1050-00)

The PLL circuit is divided into three sections: the VCO unit, the A LOOP section and the B LOOP section.

1. B LOOP section (X50-1540-00)

Q4 oscillates at 13.215 MHz. 10 and 100 Hz data from the digital unit is converted into an analogue signal by R25 through R37. This analogue signal biases D2 and varies the signal generated by Q4 within a range of 980 Hz. The frequency is then doubled by Q5 and the result is the heterodyne signal of the B LOOP section. Q1 is the VCO(voltage controlled oscillator) of the B LOOP. The oscillated signal is buffered by Q3, then mixed with the 8.83 MHz CAR signal by IC1 to obtain the difference between the two frequencies. The difference signal is then mixed with the heterodyne signal by IC2. Then the signal from IC2 is divided by IC3 to 1 kHz with the 1 to 100 kHz data from the digital unit. This 1 kHz signal is phase compared by IC4 with the 1 kHz signal obtained by dividing the 100 kHz reference signal from the A LOOP section. The comparator output is applied to the VCO through the low pass filter consisting of Q6 thru Q8 to control the VCO frequency. The VCO signal is output to the A LOOP section via buffer Q2.

2. A LOOP section (X50-1530-00)

Q1 oscillates at 14.190 MHz. This frequency is doubled by Q2, Then tripled by Q3. The result is the heterodyne signal of the A LOOP section. This heterodyne signal is mixed with the signal from the VCO section by IC1, then the mixed signal is amplified by IC2. IC3 mixes this signal with the signal from the B LOOP section.

BAND data from the digital unit is applied to IC4 to divide the signal from IC8 into 100 kHz.

IC5 generates 8 MHz and divides it into 100 kHz.

This 100 kHz signal is the reference signal. The 100 kHz signal from IC4 is phase compared with the reference signal by IC6. IC6 outputs VCV which controls VCO in the VCO unit.

IC7 converts the BAND data into an analogue signal to automatically tune T1 and T2 to obtain a 5 MHz bandwidth. When PLL is unlocked, D5 or D4 is ON and UK is "H".

3. VCO unit (X50-1520-00)

Q1 is a VCO which is controlled by VCV. The VCO signal is buffered by Q2, then sent to the A LOOP section. Q3 and Q4 are buffers. The VCO signal to generate the HET signal for the RF unit is output through these buffers. When PLL is unlocked, UK turns Q9 ON so Q8 is turned OFF. Then the buffers are tuned off so that the VCO output is not applied to the RF unit. Q5 and Q6 ground the VCV signal when the voltage of PL8 drops temporarily.

When the PLL is unlocked during repair or adjustment, turn the power OFF once, then turn it ON again and the PLL will be locked.

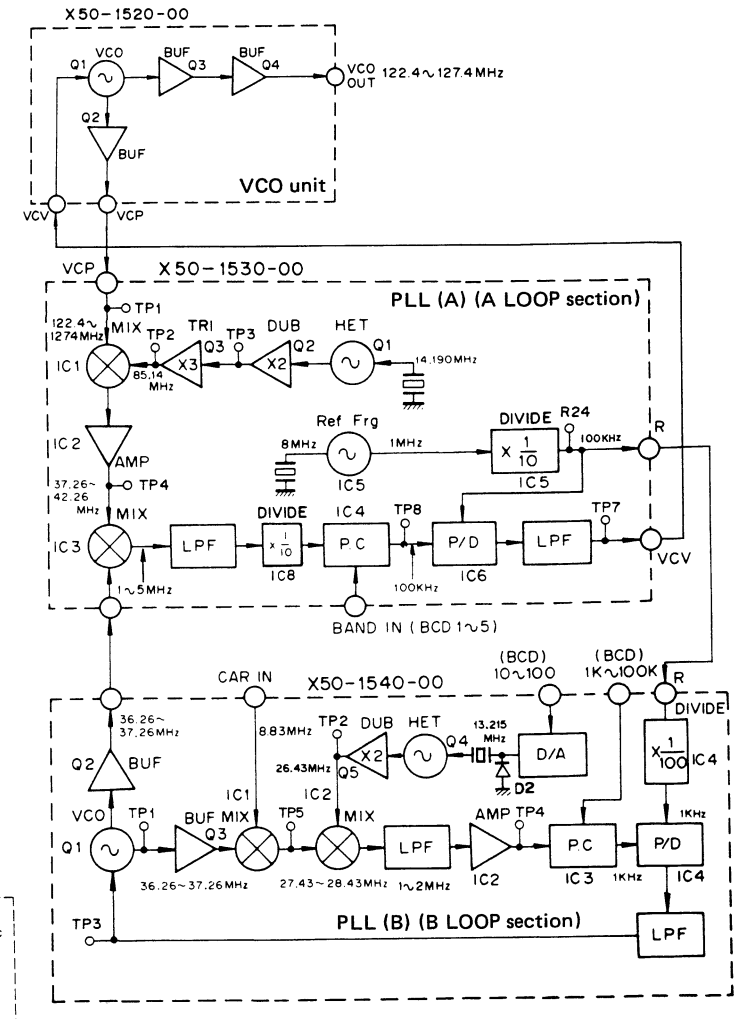


Fig. 40 PLL assembly block diagram

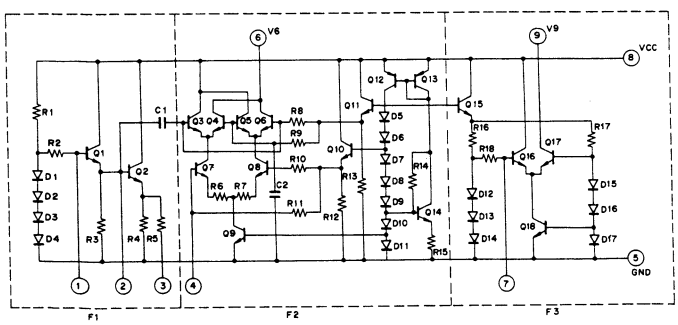


Fig. 41 Equivalent circuit of IC3 of PLL (A) and IC2 of PLL (B) (TA7310P)

CIRCUIT DESCRIPTION

FREQUENCY CONVERSION SYSTEM

Table 1 shows frequencies of oscillators in the TS-770E.

The double conversion system is used in all reception and transmission modes other than FM transmission.

In SSB and CW transmission, the 8.83 MHz CAR oscillator signal is mixed with a audio signal to generate the 8.83 MHz 1st IF signal.Then, the 1st IF signal is mixed with the 30.43 MHz signal to generate the 21.6 MHz signal. In FM transmission the 21.6 MHz generated by the crystal controlled oscillator in the IF unit is directly frequency modulated.

For 144 MHz transmission, the 21.6 MHz 2nd IF signal is mixed with the 144 MHz band heterodyne signal(122.4 MHz) which is generated by the VCO unit, to generate the 144 MHz signal which is fed to the 144 MHz final unit.

For 430 MHz transmission, the 286 MHz(or 291 MHz) signal is mixed with the 122.4~127.4MHz VCO signal to generate the 430MHz band heterodyne signal(408.4~418.4 MHz), then the heterodyne signal is mixed with the 21.6 MHz 2nd IF signal to generate the 430 MHz signal, which is fed to the 430 MHz final unit.

For reception, the antenna signal is amplified and then mixed with the heterodyne signal for each band to generate the 21.6 MHz 1st IF signal.

For SSB and CW reception, the 21.6 MHz signal is mixed with the 30.43 MHz siganl to generate the 8.83 MHz 2nd IF signal.

For FM reception, the 21.6 MHz signal is mixed with the 22.055 MHz signal to generate the 455 kHz 2nd IF signal.

Unit	Mode/band	Frequency generated
CAR unit	USB, CW-R	8.8315 MHz
	LSB	8.8285 MHz
	FM	8.830 MHz
	CW-T	8.8307 MHz
IF unit	USB,LSB,CW	30.430 MHz
IF unit (MIX unit)	430 MHz band	15.8888X18=286 MHz 16.1666X18=291 MHz S/N 930001~0040500
	430 MHz band	47.66x6=286 MHz 48.5X6=291 MHz S/N 0040501~
IF unit	FM transmission	26.1 MHz
RF unit	FM reception	22.055 MHz
VCO unit	All modes	122.4~127.4 MHz

Table 1 Oscillator frequencies

SIGNALS 14H AND 43H (144 MHz band and 430 MHz band heterodyne signals)

The VCO output signal is used for the 144 MHz band heterodyne(HET) signal 14H as is.

The 430 MHz band heterodyne signal 43H is generated as follows. The 430MHz band is divided into two bands, 430~434 and 435~439MHz. A local oscillator is provided for each band. These local oscillator signals are mixed with the VCO output signal to generate the 408.4~418.4MHz signal. This signal is used as 43H. Either of the circuits shown in **Figures 1 and 2** is used to generate 43H according to the set's serial number.

Transmitter and receiver block diagrams are shown in **Figures 3 and 4**, respectively.

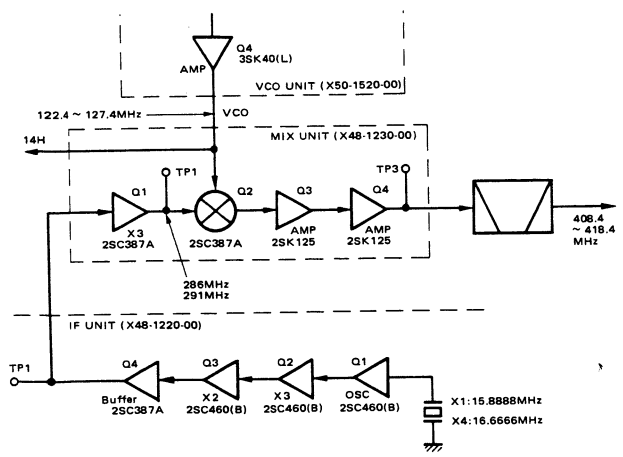


Fig.1 70 cm band heterodyne signal generator (1) (S/N 930001~0040500)

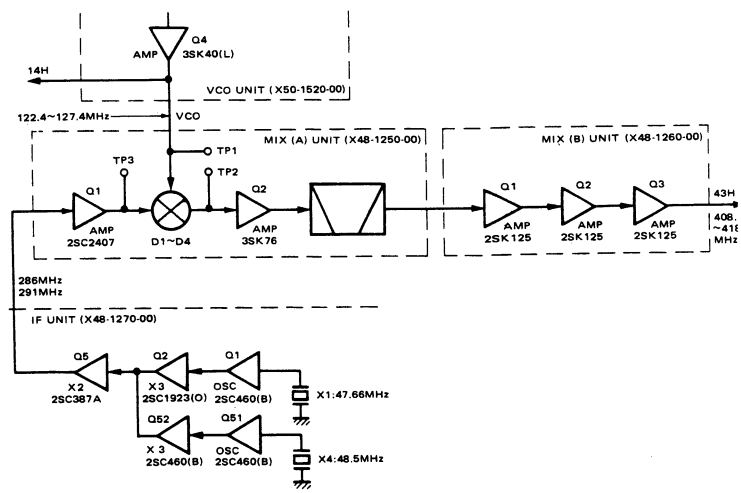


Fig. 2 70 cm band heterodyne signal generator (2) (S/N 0040501~)

CIRCUIT DESCRIPTION

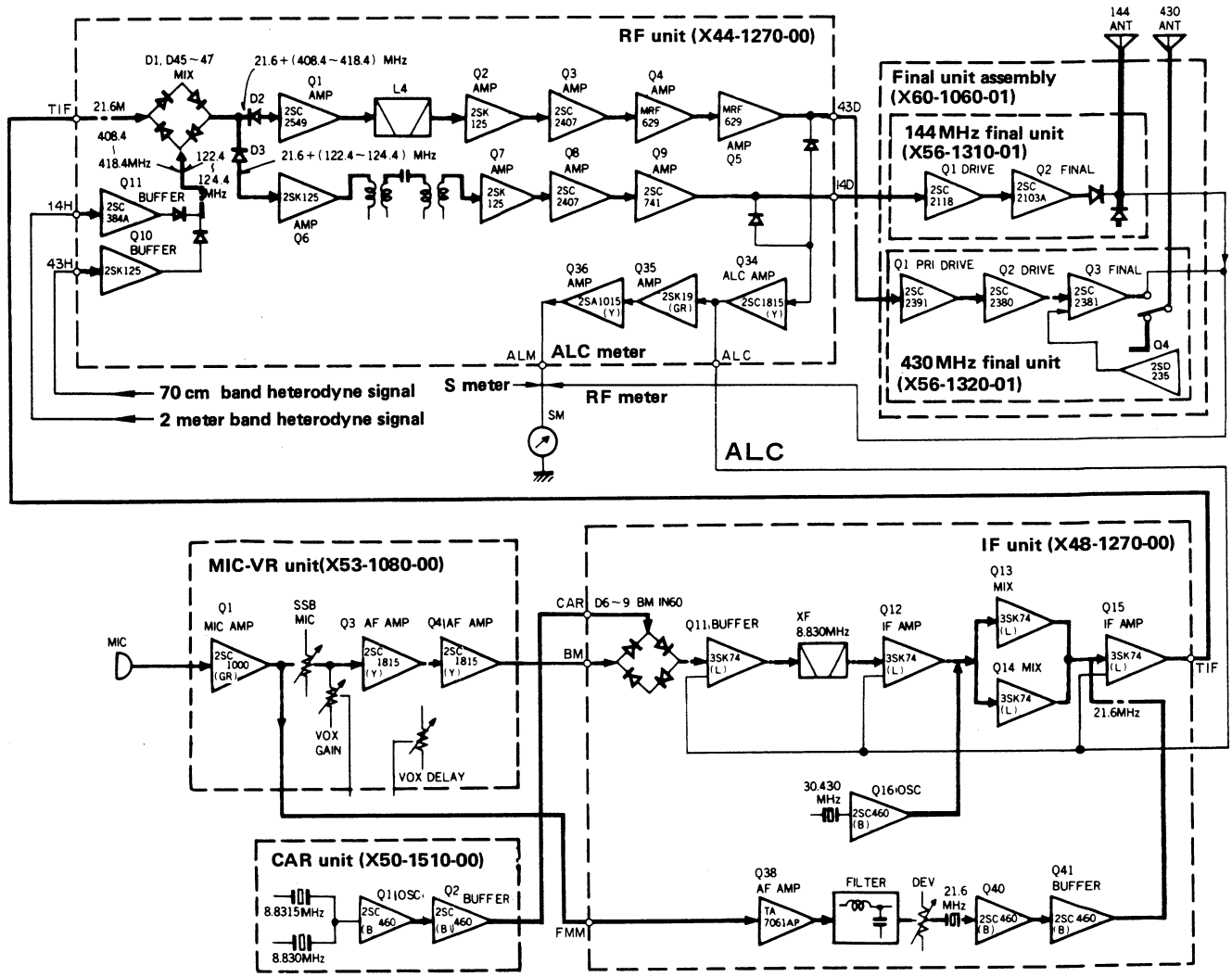


Fig. 3 Transmitter block diagram

"814", "843", 14S AND 43S (band switching signals and transmission control signals)

Band switching signals "814" and "843" are generated by Q2(MB3756) in the AVR unit. MB3756 is a voltage regulator IC provided with an output switching function. Its equivalent circuit is shown in **Figure 5**. Pin 1 always outputs 8 V. Pin 8 outputs 8 V when Pin 5 is "H", that is, it outputs 8 V during operation on the 144 MHz band. This 8 V signal is used as "814". Pin 6 outputs 8 V when Pin 5 is "L", that is, it outputs 8 V during operation on the 430 MHz band. This 8 V signal is used as "843".

14S and 43S are generated by IC1(TC4011BP:NAND gates). These signals control the TX AVR in the RF unit to alternate 14T(+B for 144 MHz transmission) and 43T(+B for 430 MHz transmission).

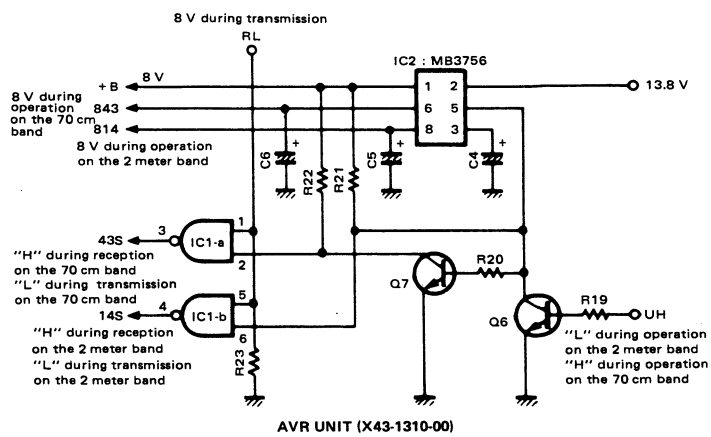


Fig. 5 "814", "843," 14S and 43S generator

SCHEMATIC DIAGRAM

Signal — Control — Common DC line

VCO UNIT (X50-1520-00)

6KEY SWUNIT (X41-1160-00)

MIX(A) UNIT (X48-1250-00)

MIX(B) UNIT (X48-1260-00)

CAR UNIT (X50-1510-00)

RF UNIT (X44-1270-00)

IF UNIT (X48-1270-00)

ENCODER ASSY UNIT (X60-1080-61)

PLL-ASSY UNIT (X60-1050-00)

DIGITAL UNIT (X54-1490-61)

MIC VR UNIT (X53-1080-00)

DISPLAY UNIT (X54-1390-00)

AF-VR UNIT (X53-1090-00)

AVR UNIT (X43-1310-00)

TONE SW

BAND SW

FAST IND

S. METER

MIC

LEVER SW UNIT (X41-1180-00)

CONTROL UNIT (X53-1170-60)(1/2)

COMMON PARTS LIST

RF UNIT (X44-1270-00)

Ref. No.	Parts No.	Description		Re-marks
TC1	C05-0030-15	Ceramic trimmer	20pF	
TC2	C05-0031-15	Ceramic trimmer	10pF	
TC3	C05-0062-05	Ceramic trimmer	6pF	
TC4		not used		
TC5,6	C05-0031-15	Ceramic trimmer	10pF	
TC7	C05-0067-05	Ceramic trimmer	25pF	
TC8	C05-0031-15	Ceramic trimmer	10pF	
TC9,10	C05-0067-05	Ceramic trimmer	25pF	
TC11	C05-0309-05	Ceramic trimmer	40pF	
TC12,13	C05-0031-15	Ceramic trimmer	10pF	
TC14		not used		
TC15	C05-0309-05	Ceramic trimmer	40pF	
TC16	C05-0031-15	Ceramic trimmer	10pF	
TC17	C05-0062-05	Ceramic trimmer	6pF	
TC18	C05-0308-05	Ceramic trimmer	4pF	
TC19	C05-0031-15	Ceramic trimmer	10pF	
	C05-0311-05	Piston trimmer (for L79-0450-05)x3		
	C90-0118-05	Through type cap.(for L79-0450-05)		
	E04-0154-05	Coax.connector x6		
	E23-0055-05	1P through terminal		
	J31-0502-04	PC board collar x9		
	J42-0404-05	PC board bush x9		
L1		not used		
L2	L34-0741-05	Coil	3.5t with tap	☆
L3	L33-0026-05	Choke coil		
L4	L79-0449-05	Helical resonator	430 MHz(B)	☆
L5	L34-0741-05	Coil	3.5t with tap	☆
L6	L33-0026-05	Choke coil		
L7	L34-0740-05	Coil	1.5t	☆
L8	L34-0453-05	Coil	3t	
L9	L33-0026-05	Choke coil		
L10	L34-0739-05	Coil	1.5t	☆
L11,12		not used		
L13	L34-0739-05	Coil	1.5t	☆
L14		not used		
L15	L33-0026-05	Choke coil		
L16	L34-0739-05	Coil	1.5t	☆
L17,18	L33-0222-05	Choke coil		
L19	L34-0499-05	Coil	4t	
L20	L33-0222-05	Choke coil		
L21	L34-0742-05	Coil	5t	☆
L22	L34-0499-05	Coil	4t	
L23	L33-0026-05	Choke coil		
L24	L34-0452-05	Coil	6t	
L25	L34-0499-05	Coil	4t	
L26		not used		
L27	L34-0498-05	Coil	2.5t	
L28		not used		
L29	L33-0002-05	Choke coil		
L30	L79-0448-05	Helical resonator	430 MHz(A)	☆
L31		not used		
L32	L34-0498-05	Coil		
L33	L79-0449-05	Helical resonator	430 MHz(B)	☆
L34		not used		
L35	L34-0743-05	Coil		☆
L36	L33-0002-05	Choke coil		
L37,38	L40-4711-03	Ferri-inductor	470μH	
L39	L40-1011-03	Ferri-inductor	100μH	
L40	L79-0450-05	Helical resonator	144 MHz	☆
L41	L33-0002-05	Choke coil		
T1		not used		
T2,3	L19-0309-05	Wide band trans.		☆
T4,13		not used		
T5~7	L34-0747-05	Tuning coil	144 MHz	☆
T8	L34-0850-05	Tuning coil	124 MHz	☆
T9	L34-0694-05	Tuning coil	144 MHz	
T10~12	L34-0749-05	Tuning coil	21.6 MHz	☆
T14	L34-0750-05	Tuning coil	455 kHz	☆
T15	L34-0535-05	Tuning coil	8.83 MHz	
T16,17	L34-0694-05	Tuning coil	144 MHz	
T18	L34-0850-05	Tuning coil	124 MHz	☆
XF1(A,B)	L71-0225-05	Monolithic filter	25B	☆
X1	L77-0827-05	Crystal	22.055 MHz	☆
VR1,2	R12-1404-05	Trim. pot	4.7kΩ	
VR3	R12-3415-05	Trim. pot	22kΩ	
VR4	R12-6403-05	Trim. pot	470kΩ	
VR5	R12-3415-05	Trim. pot	22kΩ	
VR6	R12-6403-05	Trim. pot	470kΩ	

MIX (A) UNIT (X48-1250-00)

Ref. No.	Parts No.	Description		Re-marks
TC1	C05-0309-05	Ceramic trimmer	40pF	
TC2	C05-0062-05	Ceramic trimmer	6pF	
L1	L34-0888-05	Coil		☆
L2	L34-0751-05	Coil		
L3	L33-0026-05	Choke coil		
L4	L33-0605-05	Choke coil		
L5	L33-0025-05	Choke coil		
L6	L79-0456-15	Helical resonator		
T1,2	L19-0309-05	Wide band trans.		

MIX (B) UNIT (X48-1260-00)

Ref. No.	Parts No.	Description	Re-marks
L1	L34-0499-05	Choke coil	
L2	L34-0756-05	Coil	
L3	L34-0499-05	Choke coil	
L4	L34-0756-05	Coil	
L5	L34-0499-05	Choke coil	
L6	L34-0756-05	Coil	
L7~9	L33-0026-05	Choke coil	
J1,2	E04-0154-05	Coax connector	
	J31-0502-04	PC board collar x2	
	J42-0404-05	PC board bush x2	

COMMON PARTS LIST

IF UNIT (X48-1270-00)

Ref. No.	Parts No.	Description		Re-marks
TC1,2	C05-0062-05	Ceramic trimmer	6pF	
TC3	C05-0310-05	Ceramic trimmer	10pF	
TC6	C05-0031-15	Ceramic trimmer	10pF	
TC7	C05-0030-15	Ceramic trimmer	20pF	
	E04-0154-05	Coax connector		
L1	L34-0437-05	Oscillating coil		
L2	L34-0753-05	Tuning coil	96MHz	
L3	L40-1021-03	Ferri-inductor	1mH	
L4	L34-0753-05	Tuning coil	96MHz	
L5	L40-2211-03	Ferri-inductor	220μH	
L6,7	L34-0753-05	Tuning coil	96MHz	
L8	L40-2211-03	Ferri-inductor	220μH	
L9		not used		
L10,11	L34-0756-05	Coil		
L12	L40-1011-03	Ferri-inductor	100μH	
L13,14	L40-1021-03	Ferri-inductor	1mH	
L15	L40-1011-03	Ferri-inductor	100μH	
L16	L34-0567-05	Tuning coil	8MHz	
L17	L34-0754-05	Tuning coil	8MHz	
L18,19	L40-1021-03	Ferri-inductor	1mH	
L20	L34-0536-05	Tuning coil	8MHz	
L21	L34-0534-05	Tuning coil	8MHz	
L22	L34-0755-05	Tuning coil	21.6MHz	
L23,24	L34-0749-05	Tuning coil	21.6MHz	
L25		not used		
L26	L34-0749-05	Tuning coil	21.6MHz	
L27	L34-0505-05	Tuning coil		
L28.29	L34-0536-05	Tuning coil	8MHz	
L30	L34-0537-05	Tuning coil	8MHz	
L31	L34-0538-05	Tuning coil	8MHz	
L32	L34-0754-05	Tuning coil	8MHz	
L33	L40-1021-03	Ferri-inductor	1mH	
L34	L40-1511-03	Ferri-inductor	150μH	
L35	L34-0535-05	Tuning coil	8MHz	
L36	L34-0536-05	Tuning coil	8MHz	
L37	L40-1511-03	Ferri-inductor	150μH	
L38	L34-0535-05	Tuning coil	8MHz	
L39		not used		
L40	L34-0536-05	Tuning coil	8MHz	
L41	L40-1021-03	Ferri-inductor	1mH	
L42	L40-1011-03	Ferri-inductor	100μH	
L43	L40-1511-03	Ferri-inductor	150μH	
L44	L40-1021-03	Ferri-inductor	1mH	
L45		not used		
L46	L40-3311-03	Ferri-inductor	330μH	
L47,48	L40-1021-03	Ferri-inductor	1mH	
L49		not used		
L50	L40-1021-03	Ferri-inductor	1mH	
L51	L30-0199-05	IFT		
L52		not used		
L53	L30-0285-05	Discri coil		
L54	L30-0286-05	Discri coil		
L55		not used		
L56	L40-1545-06	Ferri-inductor	150mH	
L57	L33-0264-05	Choke coil	30μH	
L58	L33-0032-05	Choke coil	3μH	
L59	L40-1021-03	Ferri-inductor	1mH	
L60	L34-0749-05	Tuning coil	21.6MHz	
L61	L40-6825-04	Ferri-inductor	6.8mH	
L62	L40-1021-03	Ferri-inductor	1mH	
L63	L40-1511-03	Ferri-inductor	150μH	
L64	L34-0437-05	Oscillating coil		
L65,66	L34-0753-05	Tuning coil	96MHz	
L67	L40-2211-03	Ferri-inductor	220μH	
L68,69	L34-0753-05	Tuning coil	96MHz	
L70,71	L40-2211-03	Ferri-inductor	220μH	
XF1	L71-0208-05	Xtal filter	SSB 8.83MHz	
CF1	L72-0316-05	Ceramic filter	CFW455E 455kHz	
X1	L77-0865-05	Crystal	47.66MHz	☆
X2	L77-0844-05	Crystal	30.430MHz	
X3	L77-0845-15	Crystal	21.60MHz	
X4	L77-0864-05	Crystal	48.5MHz	☆
VR1	R12-0048-05	Trim. pot	100Ω	
VR2	R12-0042-05	Trim. pot	500Ω	
VR3	R12-3025-05	Trim. pot	10kΩ	
VR4	R12-1020-05	Trim. pot	1kΩ	
VR5	R12-4016-05	Trim. pot	50kΩ	
VR6	R12-2015-05	Trim. pot	5kΩ	
VR7	R12-4016-05	Trim. pot	50kΩ	
VR8	R12-2017-05	Trim. pot	5kΩ	

AF-VOX UNIT (X49-1120-62)

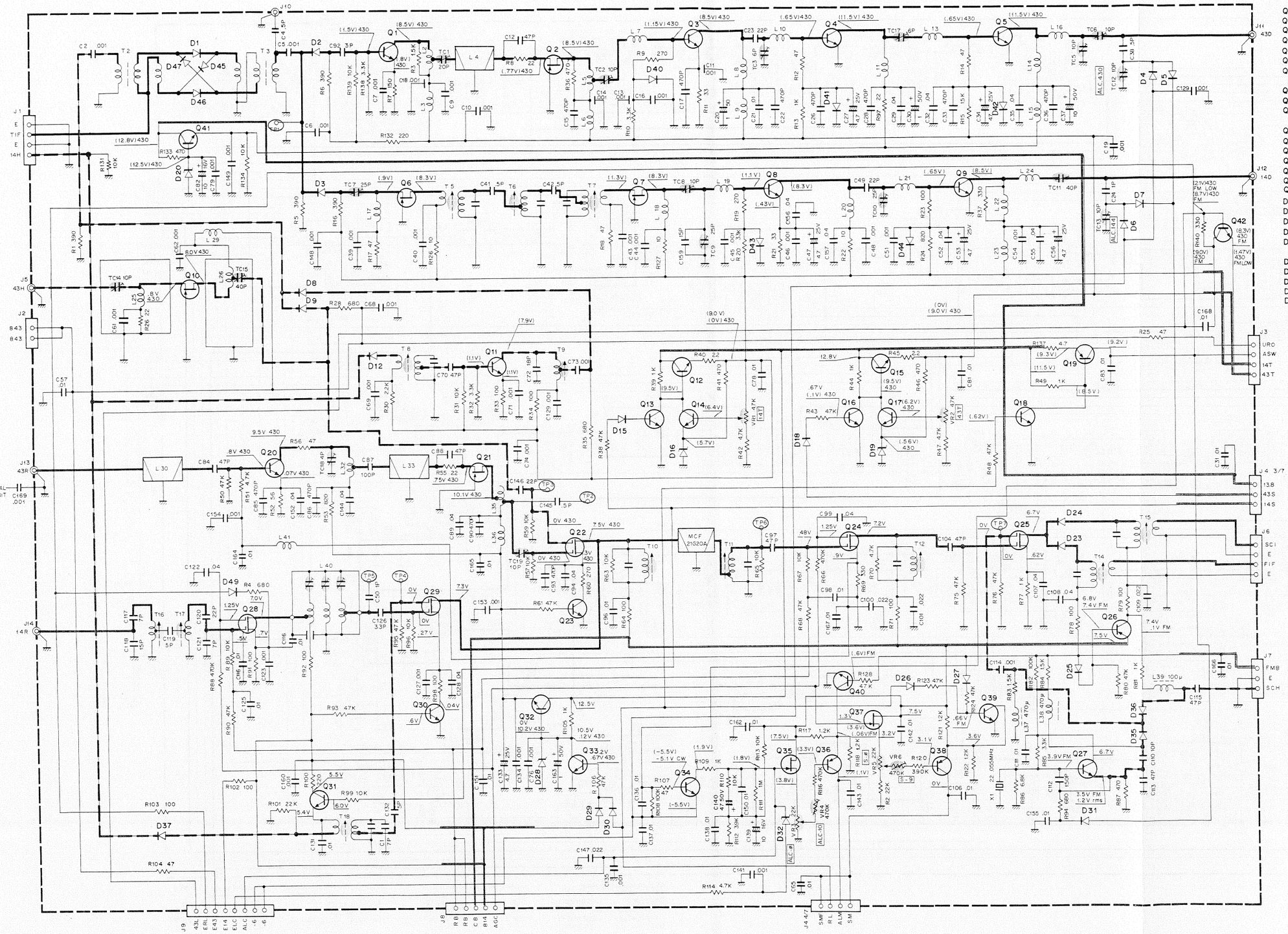
Ref. No.	Parts No.	Description		Re-marks
	G10-0603-14	Felt		☆
T1	L13-0001-05	Input trans.	500Ω:20kΩ	
L1	L33-0025-05	Choke coil	1μH	
VR1	R12-3412-05	Trim. pot	10kΩ(B) FM MIC	☆
VR2	R12-3408-05	Trim. pot	47kΩ(B) SIDE TONE	
VR3	R12-0405-05	Trim. pot	330Ω(B) ANTI VOX	
VR4	R12-0053-05	Trim. pot	500Ω	
	T95-0051-05	Transducer	BZ-1	☆

CAR UNIT (X50-1510-00)

Ref. No.	Parts No.	Description		Re-marks
TC1	C05-0031-15	Ceramic trimmer	10pF	
TC2	C05-0309-05	Ceramic trimmer	40pF	☆
TC3	C05-0031-15	Ceramic trimmer	10pF	
TC4	C05-0309-05	Ceramic trimmer	40pF	☆
L1~5	L40-1021-03	Ferri-inductor	1mH	
L6	L32-0201-05	Oscillating coil		
L7,8	L40-1511-03	Ferri-inductor	150μH	
X1	L77-0826-05	Crystal	8.8315MHz	☆
X2	L77-0825-05	Crystal	8.8293MHz	☆

CIRCUIT DIAGRAM

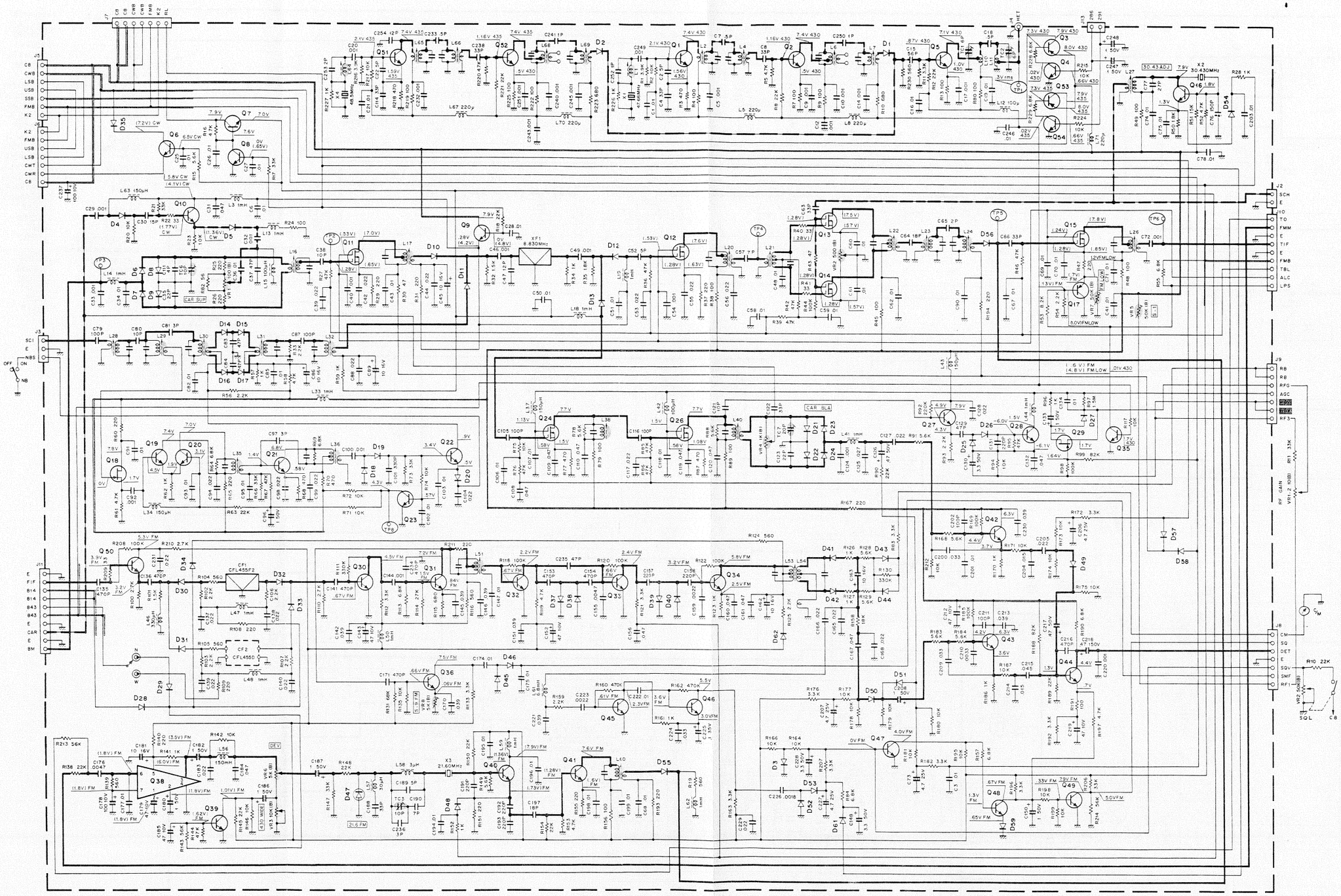
RF Unit (X44-1270-00)



Q2,6,7,10,21	: 2SK125
Q3,8	: 2SC2407
Q4,5	: MRF629
Q9	: 2SC741
Q11	: 2SC387A
Q12,15,41	: 2SD235
Q13,14,16~18,23 30,31,33,34,39,40	: 2SC1815(Y)
Q19	: 2SA562(Y)
Q1,20	: 2SC2549
Q22	: 3SK92 or 3SK76
Q24,25	: 3SK74(L)
Q26,36,38	: 2SA1015(Y)
Q27	: 2SC460(B)
Q28,29	: 3SK40(L)
Q32	: 2SC735(Y)
Q35,37	: 2SK19(GR)
Q42	: 2SC496(Y)
D1,45~47	: 1SS97
D2,3,8,9	: 1S2588
D6,7,25	: 1N60
D12,23,24,35~37	: 1S1587
D15,18,26,27,29~31 41,42,44,49	: 1S1555
D16,19,32	: XZ060
D20	: XZ132
D28	: XZ117
D40,43	: MU13
D4,5	: 1SS16

CIRCUIT DIAGRAM

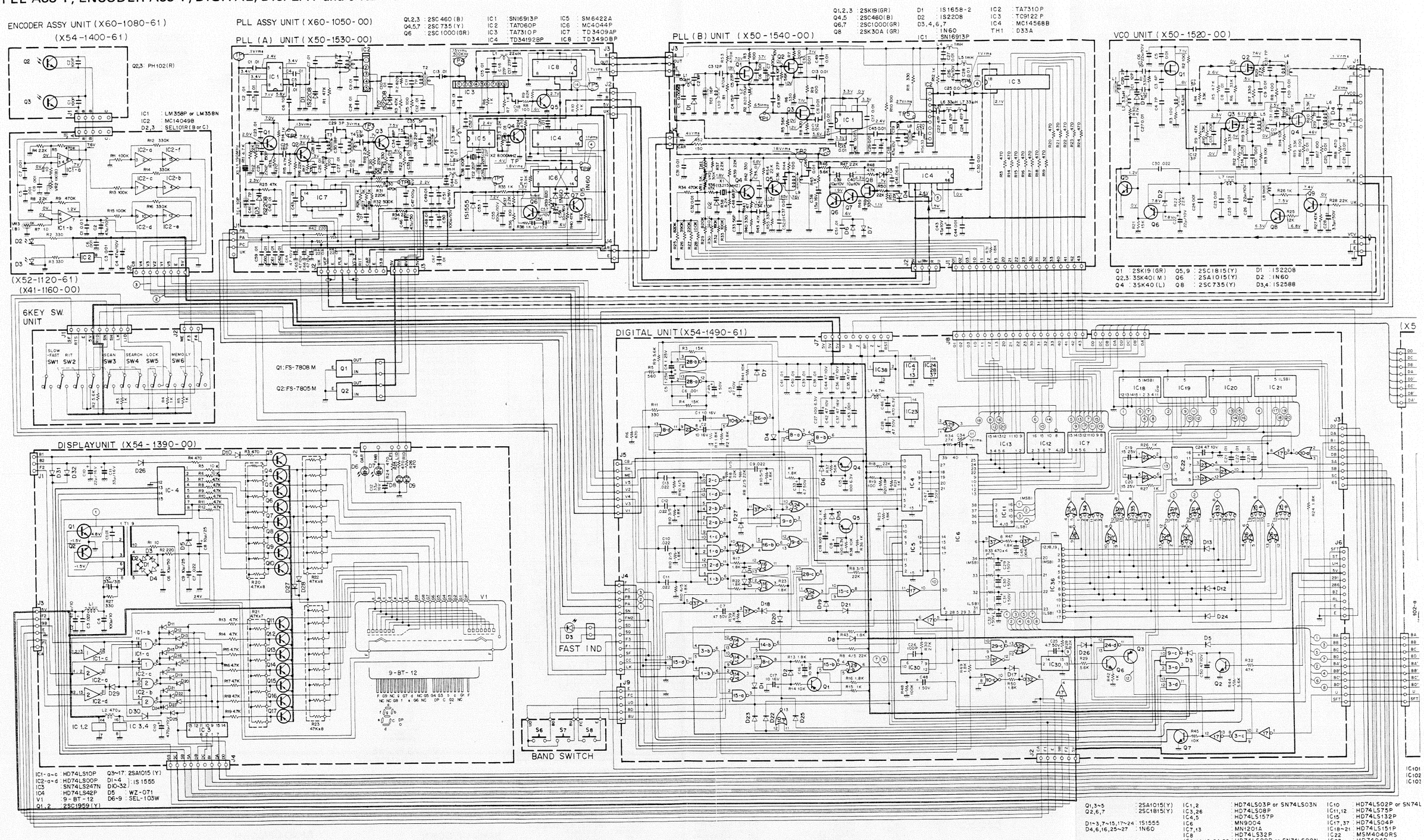
IF Unit (X48-1270-00)



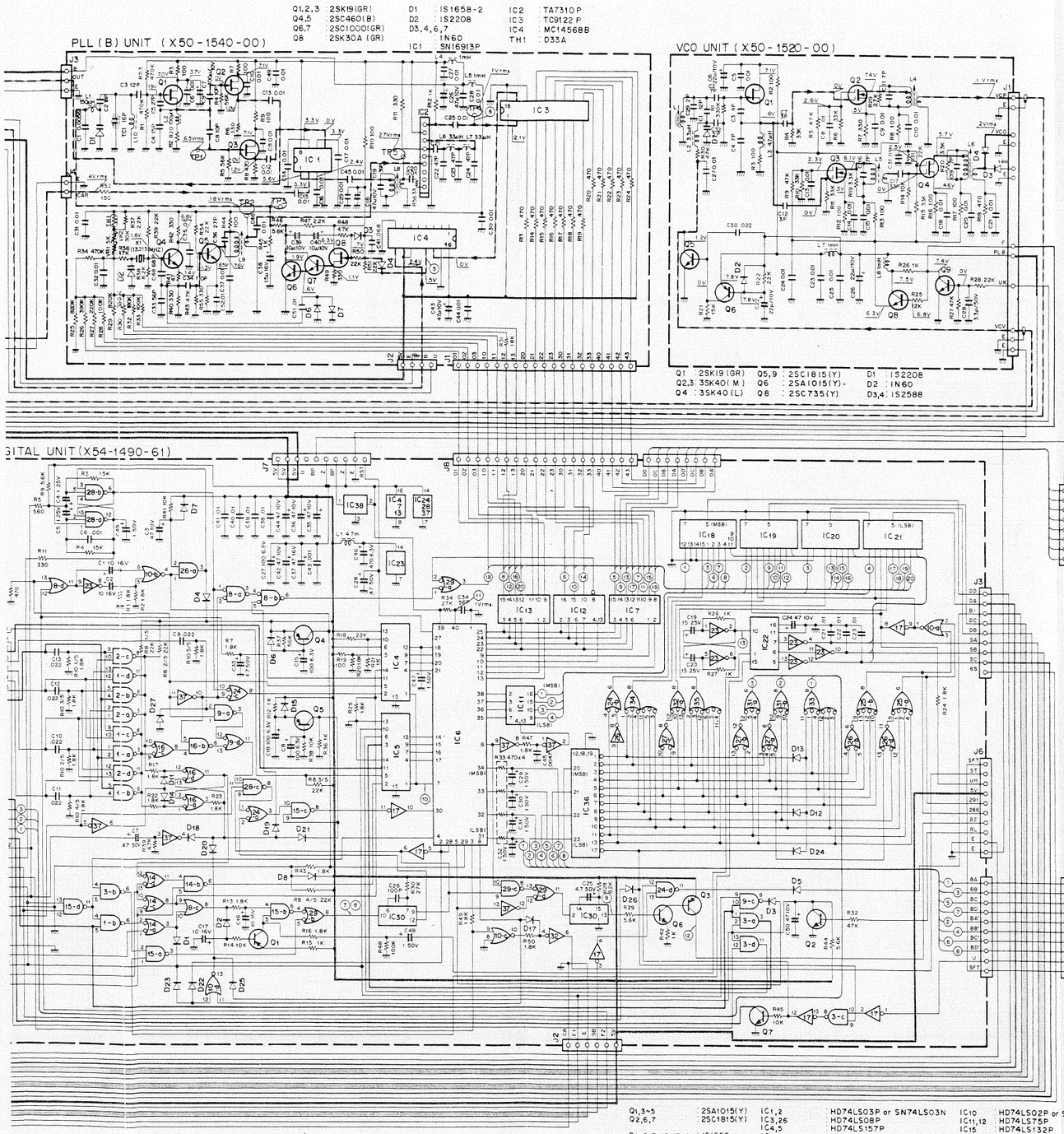
Q1,2,10,16,19~21,30~34, 40,41,50~52	: 2SC460(B)	Q11~15,24,26	: 3SK74 (L)	D1, 2	: 1S2588	D5,10~17,30~33	: 1S1587
Q3,17,53	: 2SA1015(Y)	Q18	: 2SK19 (GR)	D3	: 1S1212	D6~9,18,19,21~26, 41~46,52,53	: 1N60
Q4,6~9,22,23,27,28, 35,39,42~49	: 2SC1815(Y)	Q29	: 2SK30A(O)	D4,27~29,34,35, 37~40,48~51, 54~59,61,62	: 1S1555	D20	: MV-13
Q5	: 2SC387A	Q36	: 2SC1345(E)			D47	: 1S2208
		Q38	: TA7061AP				

CIRCUIT DIAGRAM

PLL ASS'Y, ENCODER ASS'Y, DIGITAL, DISPLAY and 6 KEY SWITCH Unit.



CIRCUIT DIAGRAM



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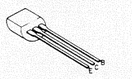
2SC1815(Y)
2SC1959(Y)



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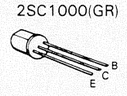
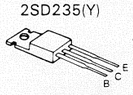
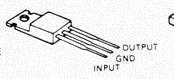
2SC387A
2SC735(Y)
2SC1000(GR)



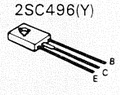
2SA671TD(B)
2SD235(Y)



FS-7805M
FS-7808M



2SC496(Y)



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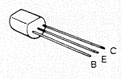
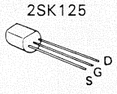
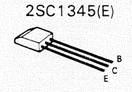
2SC2549



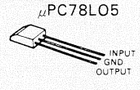
2SK125



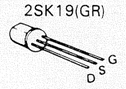
2SC460(B)
2SC1345(E)



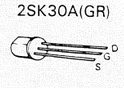
μPC78LO5



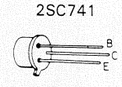
2SK19(GR)



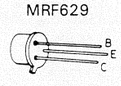
2SK30A(GR)



2SC741

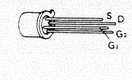


MRF629

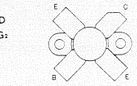


2SC2118

3SK40(L,M)
3SK76
3SK92



2SC2103A
2SC2380
2SC2381
2SC2391



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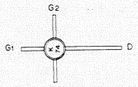
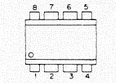


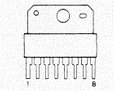
TA7060P

TA7061AP

LM358P
SM6422A
SN16913P



MB3756



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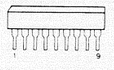
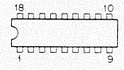
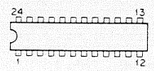


HA1366W

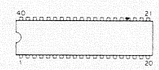
TC9122P



HD74154P



MN9004



HD74LS00P
HD74LS02P
HD74LS03P
HD74LS04P
HD74LS08P
HD74LS10P
HD74LS11P

HD74LS20P
HD74LS30P
HD74LS32P
HD74LS132P
HD7404P
MC4044P
TC4011BP

TC4023BP
TC4025BP
TC4030BP
TC4069BP
TD3490AP
TD3490BP

HD74221P
HD74LS42P
HD74LS75P
HD74LS151P
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MN1201A

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MSM4040RS
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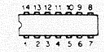
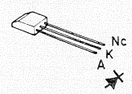
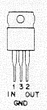
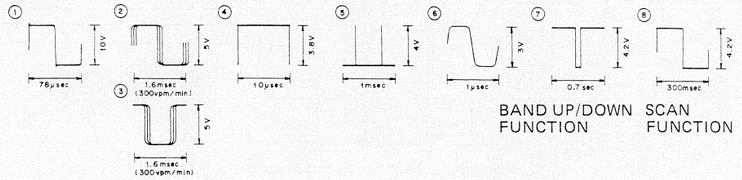


MA522(Q,R)

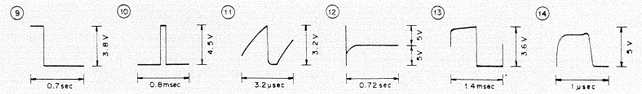


μPC7805H





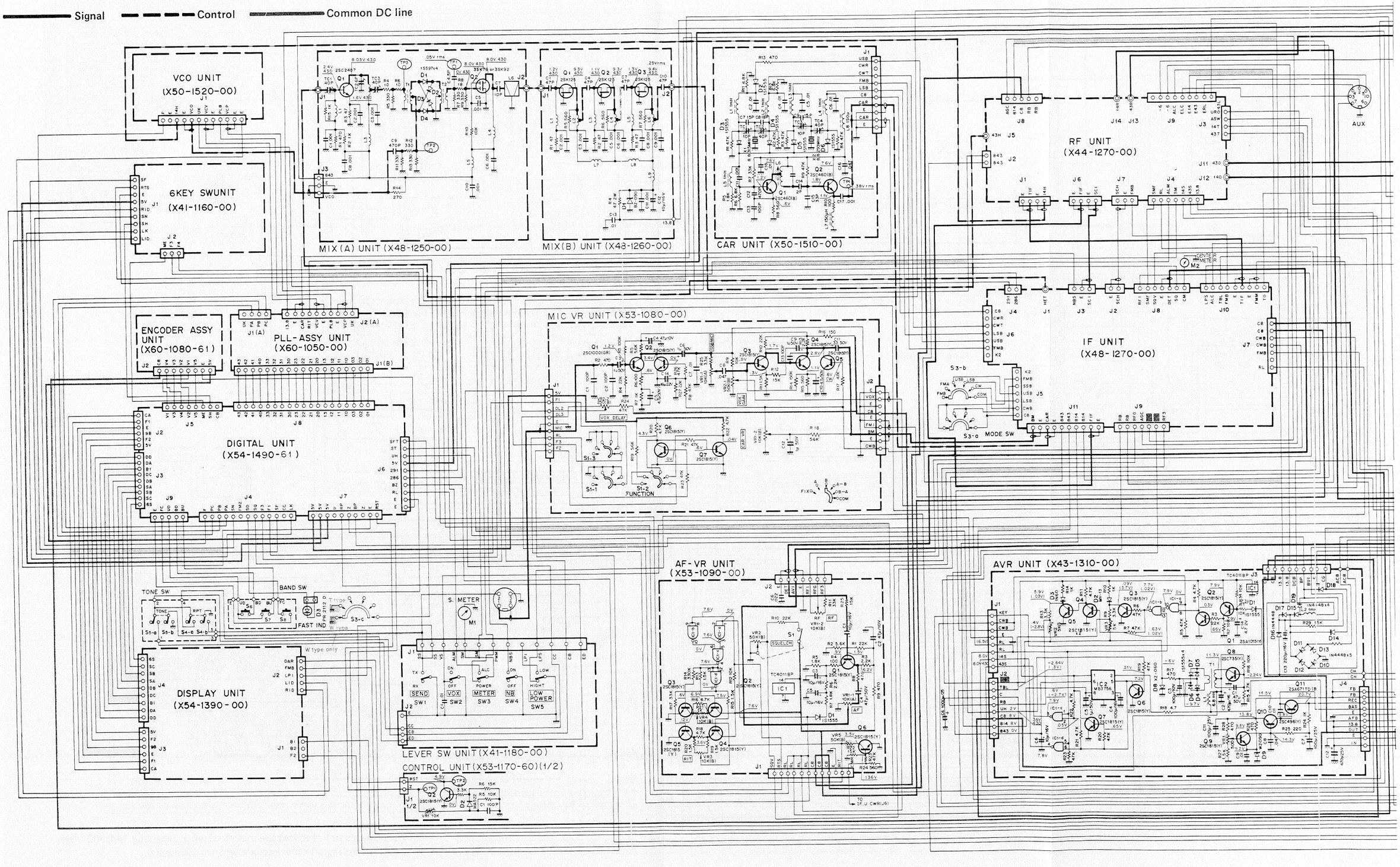
V1, V3 PHASE DIFFERENCE 90°



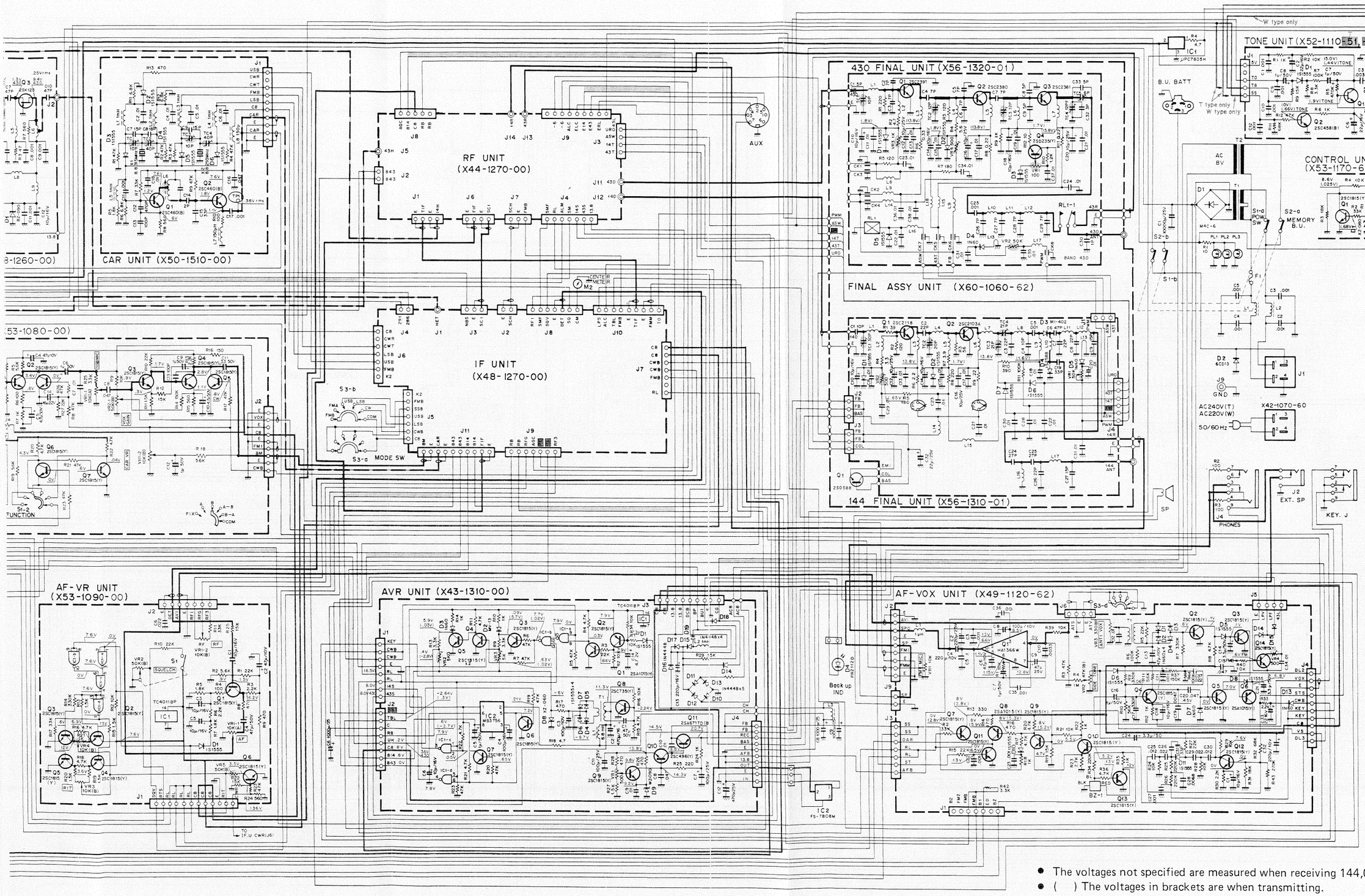
TS-770E

SCHEMATIC DIAGRAM

Signal — Control — Common DC line



SCHEMATIC DIAGRAM



- The voltages not specified are measured when receiving 144,000 MHz.
- ( ) The voltages in brackets are when transmitting.